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EDITORIAL NOTES.

The Coal Strike, and Coal from Abroad.

"THE best laid schemes o' mice and men gang aft a-gley." The old adage, pregnant with truth, seemed to have a fresh interest as one listened to the explanation of the Chairman of the South Metropolitan Gas Company (Mr. Charles Carpenter) last Wednesday as to the causes that, despite the long-laid precautions of the Board, resulted in the solid cash loss to the Company on coal last half year of about £89,000, of which £75,000 has been reimbursed to the half year by a transfer from the insurance fund to the net revenue account. The explanation, and generally the question of coal strikes and their effects, supplied the theme for the greater part of the Chairman's speech; and, though the other matters were interesting, relatively, on this particular occasion, they were unimportant. The precautions taken to prevent loss in the event of a coal strike, and yet the substantial loss referred to, serve as a caustic comment upon the conditions that, for some period anterior to the strike, ruled supply from the coal-fields and compliance with the demand of the largest consumers of coal. A matter that forces itself upon one as not a little strange, however, in connection with diverse experiences in preparedness for the strike, is that some undertakings were more fortunate than others in getting delivery of their contract quantities before the great event, and this applies to foreign gas-works as well as to British undertakings. Perhaps conditions of demand and working at the particular pits from which the more fortunate ones drew their contract supplies are more accountable for this than preferential treatment.

Looking back, no one can accuse the Directors of the South Metropolitan Company of any want of prevision, or of neglect of practical precaution. Glancing at several consecutive accounts half year by half year, we find that at the end of June, 1908, the Company had in store 86,806 tons of coal, and in the following December, 114,765 tons. But since then, in view of the feeling of the Board that a strike would come at some time, and a strike of a far different nature from anything previously experienced, the Company's storage, at the end of the December half years, has approximated a quarter of a million tons; and the close of each June has found them, in succeeding years, with coal in store well over 100,000 tons, and usually round about 140,000 to 150,000 tons. New conditions, new necessities. Three years or so ago, the Board recognized that the local strike was passing, during which type of strike, if coal could not be obtained in the affected county, the working in other coal-yielding counties could be counted upon to provide a continuity of purchase and of delivery. They recognized, through the federation of coal workers, the dawn of the national strike, when there would be a simultaneous closing-down of pits, and the output of coal throughout the country would be effectually stopped. Hence the additional provision that emanated from prevision. But that was not all. In the spring of 1911, contracts for coal sufficient for full requirement were made up to the end of June this year; the normal time for completing the delivery of the coal being March. But withal, the Company could not obtain proper delivery of the coal; and the Board place the blame for this unreservedly upon the disturbance provoked by mischievous legislation. There is the plain tale of the cause of the additional expense on coal in the past half year. No Board of Directors could have done more to avert direct loss through external causes of the kind.

From causes to effects. The latter were dealt with by us in making survey of the accounts last week. There is, however, another interesting and instructive side to the experience; and the Chairman is thanked for having made public the facts. It was only the other week [see "JOURNAL" for June 25, p. 959] that M. Masse read a paper, before the Société Technique du Gaz, in which he discussed the prospects, in times of coal famine, of landing coal in European countries from America; and the conclusion at which he arrived was that this could not be entertained as an economic proposition until the facilities for coal transport were improved, and freights from America were thereby reduced. Already, however, the South Metropolitan Company were buying coal from Nova Scotia, America, and Germany, and shipping it to England, to fortify their stocks during the strike, in order to guard against any eventuality so far as the prolongation of the strike was concerned, and the extension of the void in the matter of delivery beyond the time of the return of the men to the pits. The experience should be useful to the country generally, as well as to the gas industry; and it would add to its value if Mr. Carpenter would publish the average costs of coal and freights, and particulars as to working results. If it is not politic to do this, then there must be satisfaction with the general statement that he made at the meeting of the proprietors, that the coal brought across the Atlantic yielded results equal to those of coal from Durham and Northumberland. The lesson is a valuable one, though the price of the experience was obviously heavy. But the Company were not the only buyers of coal from America during the run of the strike. The Admiralty supplied from America at least one of their coaling-stations in the Mediterranean during the failure of the home sources. Not long ago the Gaslight and Coke Company placed some small contracts with Germany, to gain experience; and certainly one or more of our large railways purchased coal from Germany over a considerable period this year. The coal owners will no doubt duly notice these incipient and tentative experiments of large coal users to supply themselves from other than home sources in emergency, and will consider the effect that successful trials may have fundamentally in ultimately promoting transport enterprise when home conditions such as the fictitious ones now prevailing enable the owners to push-up prices to an inordinate extent. The coal miners should also observe the possibilities and the bearings of such trials upon the national strike. Industries and communities have a right to defend themselves, by any means that offer, against intolerably oppressive and injury-inflicting coal conditions.

Naturally, the purchase of coal from abroad, and bringing it to this country, savours somewhat of the operation described, with a ring of contempt in the words, as "carrying "coal to Newcastle." But if "Newcastle" be deprived of its supplies, and its industries are held-up, then, though there are subterranean stores at its very doors, "Newcastle" has the right of going farther afield to supply its needs. It cannot brook industrial starvation. The problem of economic transport is the one that has to be solved so as to place America in the position of a competitor with this country, and the field of that competition is now alluringly large. It looks like an unsolvable problem at the moment. But who knows? Many things that have once appeared visionary have, in the evolution of the world's affairs, become material accomplished facts; and at all events in the home coal world things are shaping in such a way as to absolutely favour, through the new conditions created, the consideration of the question of bridging the distance between this country and sources of coal supply abroad. America has vast stores of coal, the cost of getting the coal mechanically is comparatively cheap, the supply is in excess of demand, coal is not by any means at a high price in America, and last but by no means least for the gas industry the coal is a good gas yielding one—equal to, says Mr. Carpenter, the coals of Durham and Northumberland. These are conditions that are favourable to the consideration of the one unfavourable question of transport. That is an obstacle that may never be got over; but again we say, Who knows? The fact that it is the only difficulty—trials already proving it to be so—will,

perhaps, weigh with those (if they are wise) whose operations so unpleasantly militate against the interests of this country.

This is a matter more for those immediately concerned in the coal industry than for the Government of the country. But of the Government Mr. Carpenter had one bitter complaint to make. Though the Government interested themselves so largely and ardently in securing for the miners a right to a district minimum wage, they, though representations were made to them, did not appear in the least concerned, on a resumption of work at the mines, as to whether the exigent needs of home industries were first met, or whether the first-raised coal was shipped abroad to supply the needs of other countries. The mortification had to be suffered by our home consumers of seeing ships whose destinations were foreign ports loaded-up preferably to our home boats. This was not just; and it was certainly not patriotic. There is only one point with which we disagree with the Chairman; and that is in regard to taking history as any criterion as to the frequency of coal strikes. History may tell us that coal strikes have happened about once in a generation. History also tells us that the local coal strike used to prevail; but that was no guide as to what was to happen this year, when the national strike supplanted the less injurious form of strike, and made new history. Under the new conditions, there is nothing to guide us on the point of frequency; and we have much yet to learn. However, the speech of the Chairman of the South Metropolitan Gas Company, which was not long, but much to the point on this all-important subject, stands to the front among those that have been delivered by heads of industries depending largely on coal for their support, for the lessons and rebuke it contains, and the proved grievances it portrays.

Concerning other topics of the address, we will merely say here that the Chairman was able to report continued success in the experiences with the new gas purification process to which reference was made at the meeting last February, and by which lime purification will be entirely superseded. It is probable that the year 1913 will see the whole of the Company's gas output subject to the process. The "Metro" gas-burner continues to make headway along the road of popularity; and high-pressure lighting is now expanding in the Company's area without the custom being sought. This testimony is the highest compliment that the Chairman could publicly pay to those who have brought high-pressure lighting to its present high state of efficiency. It means that high-pressure lighting can break new ground on its own intrinsic attributes. With peace in the coal-field, though coal prices are higher, the Chairman looks upon the future with bright expectation.

Gas Lighting and Ventilation.

Our competitors have a curious little way peculiar to themselves of smilingly passing by the claims of gas lighting to be an extremely good ventilating agent in rooms and other interiors, and one that assists materially in maintaining hygienic conditions of the atmosphere. But has anybody ever heard of any of these smiling competitors who have put the matter to any scientific test? We have never done so; and we rather fancy they would strongly object to be parties to any tests of a chemical nature to prove or disprove their assertions in any two rooms of similar character—the one with electric lighting and the other with gas lighting, and both tenanted. They much prefer moving along satisfied with platitude and postulation, but nothing more positive, on this particular subject. One bad effect of this is that some people are apt to pay attention to the baseless assertions of these competitors simply because they do not know any better, or are too indolent to inquire further into the matter. We have known medical men who have accepted the plausible tale of men even less qualified to speak than themselves, and accepted it without the remotest idea of investigating the truth or otherwise of it. Among some architects, factory inspectors, and others, the false tale has been invested with credence—not only in this country, but in others, despite the results of the work of the only men who have thoroughly and scientifically made research into the question, and who have been satisfied thereby as to the truth of the declarations of the gas industry. Apart from the endorsement of science, we cannot imagine how any mind capable of considering the subject on even the most elementary chemical and physical lines could come to any other conclusion.

The question of the ventilating properties of gas has been considered in America, with results confirmatory of those obtained in this country. The Southern Gas Association of America have had a report on the matter prepared by a Committee specially appointed to deal with it; and Mr. Charles O. Bond has published the results of experiments carried out in the photometrical laboratory of the United Gas Improvement Company. Misconception has been zealously fostered by the aid of the misrepresentation of the trade rivals of the gas industry in America just as here, and that has to be dealt with. The investigations that have been made will assist in undoing the mischief; but the circulation in the gas industry of America of the results of inquiry is not considered at all adequate. We see that the Pennsylvania Gas Association have decided to prepare a pamphlet dealing with the subject for distribution among medical men, heads of hospitals, factory inspectors, architects, and so forth. The Southern Association of America are also considering the taking of a similar step. Like work should be taken in hand by our Commercial Gas Association at home, by direct distribution of such pamphlets among professional men of influence—many of whom may have accepted erroneous views without a second thought. If they can only be, by such literature, induced to think over the matter, they must, if they have hitherto held erroneous views, be completely converted by a brief consideration of the natural laws and forces governing the position.

One of the members of the Committee of Inquiry of the Southern Association has never observed by test a diminution of more than 1 per cent. of oxygen in a room, with the doors and windows closed, in which gas-lamps and a flueless gas-heater were used; and, under such abnormal conditions, never more than 32 parts, and sometimes as low as 13 parts, of carbon dioxide in 10,000 parts have been found. These are moderate proportions compared with what physiological and medical investigation have shown to be perfectly harmless. The investigations have again demonstrated that, taking two inhabited rooms—the one illuminated electrically, and the other by gas, with no special provision for ventilation—the oxygen diminution is found to be about equal in both, a carbon dioxide increase in each, but the proportion of organic matter is greater in the atmosphere of the electrically lighted room than in that gas lighted. The explanation is easy, and so is the proof of its truth. It is simply that, in the one case, the gas-burners put to the best possible use—by drawing in air and heating it—such means of air ingress and egress as are found in a room without special ventilating provision; and by the sterilizing effect of the flames the organic pollution of the atmosphere is largely neutralized. The stagnant conditions that exist in a similar room electrically lighted and inhabited must result in the greater contamination of the atmosphere—through the respiration of the occupants of the room, and with no ventilating assistance given by the electric lamps—than is the case in a room where the air currents set up by gas-flames contribute to change of air. It is one of the easiest things in the world to say that this is not so; it is one of the hardest to prove the truth of the spoken denial.

The tests carried out in the photometrical laboratory of the United Gas Improvement Company were to ascertain exactly—using a plain flue ventilator, and a four-burner incandescent gas-lamp—the rate of air transfer from the room in which the lamp was fixed into the room above—arrangements having been made to keep a uniform circulation throughout the remainder of the building. The lower room had an air content of 5200 cubic feet; the upper one of 1700 cubic feet. When an 11 ft. 6 in. straight length of flue was used (of course, the conditions are not those that would obtain in a dwelling-house), with part of the flue protruding into the lower room, and with the top of the lamp chimney raised and lowered nearer or farther away from the flue, and placed in various situations, the discharge of air varied from 9200 cubic feet to 28,000 cubic feet per hour. In all the tests, the average discharge efficiency of this and other sized flues was between 75 and 80 per cent. in relation to the theoretical quantity that should pass under the conditions obtaining. The air of the room, it will be seen from these figures, was changed two to five times per hour through the action of the gas-lamp. The tests also point to other useful considerations in ventilating flue-construction. Ventilating openings flush with the ceiling are found to be more efficient than ventilators below the ceiling level. Further, a short length of vertical ventilating-tube and a long length of horizontal

tube are not found so efficient as a longer length of vertical tube and a shorter length of horizontal tube. The shorter the horizontal flue, and the fewer the bends, the greater the ventilating efficiency. These are simple points; but they are worth remembering in making use of the contributory work of the gas-burner in ventilating rooms and halls.

Coke Handling in Gas-Works.

A GREAT deal more attention is now being paid to the question of the production of, and the methods of dealing with, coke in gas-works than was the case but a few years ago. The desire for improvement of the material and for economizing its use on the works to the point at which it would be unprofitable to pursue further economy are part evidences of the revival of attention. It was remarked last week how the engineers of various works have found it an excellent thing to effect the conversion of waste in the works' fuel account into saving, and therefore profit. If retort-settings can be heated, and the heats be maintained, on a fuel account 4 or 5 per cent. lower than previously—perhaps more—on the coke made, then it is simply waste to use the 4 or 5 per cent., which, in the aggregate of the saving, represents a very considerable amount. But there is another striking change in connection with coke in gas-works practice. The vertical retort systems and the heavy charges of horizontal retorts have set up a new standard of coke quality—principally in the matter of physical characteristics; and it is recognized as a pity if the advantages of improved quality are sacrificed or discounted by the treatment of the material subsequent to its exit from the retorts. Those who pay close attention to the technical part of the contents of the "JOURNAL" will have noticed that of recent times this is a matter that has been receiving increased attention both from inventors and from constructors of gas-works coke-handling plant. In last week's issue, there were described in our technical columns two French inventions, both of which have for their object the better quenching, screening, and transport of the freshly made coke; and in our "Register of Patents," there were described two coke-quenching arrangements—an improvement on the Liverpool plan, and an altogether new suggestion from Berlin.

When these various proposals are considered, and when one looks round the country, and observes the extent to which the telpher system of coke transport is being adopted, one can easily trace the trend of view in the matter of the improvement of coke by the methods of handling it. One, indeed, feels almost inclined to ask whether the days of the long conveyors running in troughs in front of retort-benches, and then up inclines to the storage hoppers, are not on the wane? We see the telpher being largely adopted; we see, too, the travelling crane being advocated. By either of these systems—the one making rapid aërial flights, and only claiming ground for the standards supporting the mono-rail track, and the other claiming ground rails and a clear course—great over-all economy ought to ensue. Between these newer proposals and the coke-conveyor, there are, there can be no question, differences that are of much importance both technically and economically; and these differences in technical circles are being considered and discussed. The heavier retort charges now the vogue, and the ram-discharger, have shown up one of the defects of the coke-conveyor. It has to be built of considerable width to accommodate the charge; and the greater the width, the heavier the work to be performed by the driving machinery. The weighty local loading of the conveyors must also mean unequal strains. These are points contributing to extra power expenses and wear and tear. With all our love for old and valued servants, we cannot get away from the fact that change often demands, and must ultimately beget, change. With the telpher, the power required for raising and transmitting the loaded or empty skips is not considerable, nor is the power required for the propelling of a crane constructed lightly and of a strength sufficient for the purpose of coke-handling. There are not the same strains as in the case of a coke-conveyor of the old type; and there is not the same extent of moving parts to contribute to wear and tear. We are inclined to think that the trough coke-conveyor will have its place in the future only in those situations where other systems cannot well be applied; and perhaps its star, which is not in the ascendant at present in new work, will rise again with the extending incoming of the vertical system.

Besides reduced power and wear and tear, there is another reason why the newer transport methods are obtaining so much favour; and it is that the coke is carried. We know there are exaggerated ideas abroad as to the breeze for which a well-designed coke-conveyor is responsible. But the ideas are hard to dispel; and there can be no question that a method of transport that lifts and carries away skips of coke from the retorts to where required, without the coke itself having to be disturbed, must ensure a less quantity of breeze than the conveyor method. Moreover, the newer systems enable the engineer to get away from the old method of quenching inside the retort-house, with its clouds of sulphur-laden steam, and the corrosive action that this exerts upon steel and iron work in the house. The newer arrangements also permit of external quenching. This is an advantage; and, as we have seen, the first modes of external quenching are already being improved, in order to defend the coke from the ill-effects of violent quenching, and to as much as possible cause self-generated steam to do the extinguishing work, in order to keep the coke as free as possible from depreciating moisture. The treatment of coke in gas-works is a subject that bids fair to come once again very prominently to the front.

Tar Treating of Roadways.

THE Daily Press has lately been once more devoting some attention to the question of the treatment of the surfaces of roads by tar—a system which has given to the public immense relief from the dust nuisance, and has brought other economic conditions in its train of which the public has not so much knowledge as is perhaps desirable. An article in the "Daily Telegraph" gave prominence the other day to certain considerations, but not to all. After reading the article, the point that must impress the lay mind particularly is the considerable cost involved by the tar-surfacing of roads; but little is said of the credits that should be set against this cost. It is pointed out that last year the Kent County Council, under the advice of their Engineer (Mr. H. P. Maybury) spent on the tar treatment of 596 miles of roads no less than £34,000. This sum, according to Mr. Maybury's own report, includes £5103 paid to Urban Retaining Districts. The direct expenditure of the County Council for tar-painting alone came to £28,665; the payments for tar having been £12,583. However, the £34,000 appears a big sum, which, so far as the ratepayers are concerned, is considerably lightened by the contribution from funds of the Road Board; the funds being provided by a tax that comes out of the pockets of those who use the motor vehicles which brought about the changed traffic conditions that generated the dust trouble.

But there is yet another set-off to all this, which the writer of the article in question can trace for himself if he takes the annual accounts of the Kent County Council for the period over which tar has been employed for road surfacing in that quarter of the country. During that period, there has been a saving (distinct from improvement) on road maintenance and watering, until the difference has reached several thousands of pounds. So much so has this saving materialized, that we remarked some time ago that, without reference to the dust nuisance, the tar-surfacing of roads had proved itself an economic advantage, and on this account could not now be discarded. The same article mentions that tar, crude or distilled, has its disadvantages, and that engineers and scientists are at the present time engaged in endeavouring to obtain a bituminous or asphalte material that will be more suitable for the purpose. It is quite a natural thing to seek for something better; but seeking does not always meet with success. If a more suitable material be found, it may be that it will be far too expensive to apply to the thousands upon thousands of miles of country main roads that are now tarred. The gas industry, of course, would not be allowed to stand in the way of any superior substance for road improvement; but they have no present fear of the day of the final suppression for this purpose of their own commodity. It is admitted that tar, whether crude or distilled, has its disadvantages as well as its advantages; but the disadvantages are, experience of success and advantage indicates, due more to the character of the roadway than to the tar itself. Advocacy is strongly made of an improved construction, using a good bituminous binder; but there again such improvements can only refer to the main roads within towns, and certainly cannot, on account of its cost, be extended indiscriminately into the rural areas.

An Unlimited Field.

The past half year and the current half year have between them produced conditions that have stimulated the heating business. The coal strike was responsible for an extra demand for cooking and other apparatus in which the calorific power of gas is of importance, and a quality appreciated by consumers. Most gas undertakings experienced, as a consequence of this, a good increase in the consumption of gas in the half year; and the new connections will be a permanent advantage. The present half year—in the period of it that out of courtesy, but not because it is true, we call "summer"—has seen the thermometer oscillating between low winter temperatures up to temperatures in the neighbourhood of 60° Fahr., and never much higher; and reports come in of good percentage increases of consumption compared with the corresponding days of last year—this largely during daylight hours. The chairmen of gas companies are noticing these points in their addresses to the proprietors, and are remarking upon the progress that is being effected in the field of heating, with the comparatively cheap and easily maintained appliances the gas industry has to offer. We have Mr. G. Crispe Whiteley, at the meeting of the Bournemouth Gas and Water Company, saying "that with gas-fires, gas-cookers, and gas-heated water-boilers, the gas industry has in future room for almost unlimited development." The Bournemouth Company are showing uncommonly good records in the newest line of business—the fixing of water-heating appliances. At the Croydon meeting, Mr. Charles Hussey quoted statistics of peculiar interest, as they go to show that, great as the heating business of the gas industry has become, there is a vast reserve of ground upon which gas undertakings can operate that will make the present of this business, as development proceeds, appear in the future a mere bagatelle. Mr. Hussey's figures take no account of the houses not yet supplied with gas, nor of developments of population, dwellings, businesses, and industries. Taking the visible basis adopted for the Croydon comparison, ten years ago the Company had on hire only 53 stoves to every 100 meters in use. Five years later the number had increased to 60; and now the percentage is 78. The figures show what immense expanse and possibilities there are in this heating business. In every house in which there is a meter fixed, there is scope for three or four stoves—gas-fires and a cooker—and in some houses a greater number, apart from water-heating appliances. With the price of gas at a suitable figure, we, or our successors, will be talking of the meters fixed being the smaller number in the ratio of heating appliances to meters; they may even aspire to having 200 or 300 heating appliances per 100 meters connected.

Water-Gas Plant Control.

A useful paper was presented by Mr. G. W. Wallace on this subject to the last meeting of the Illinois Gas Association; and an abstract of the communication appears elsewhere in the "JOURNAL" to-day. Some gas workers and chemists only use gas analysis as a check on the quality of gas; but in the paper before us, Mr. Wallace advocates a close chemical control, and the use of the process of chemical analysis as a means of locating the causes of inefficiency. Articles that have been published in our columns previously have shown how neglect of control of the working of carburetted water-gas plants may result in considerable loss and dear product, while by chemical control a set can be "tuned-up" to a high level of efficiency, and by the same means the efficiency be maintained. It is quite easy to fall into conditions that will produce inefficient working with a carburetted water-gas plant; it is not difficult, and it pays, to keep the plant under proper control. Mr. Wallace's paper offers assistance to that end.

"Dagonet's" Error.

"Dagonet" is generally good and reliable in his weekly supply of "Mustard and Cress." But last Sunday week he came a cropper. Whether it was due to the fact that he takes his rambles abroad at a late hour of the day, or that his sight is not so good as it used to be, there is the fact that he has confused the high-pressure gas lighting by Keith lamps in the West-end with the services to the community of the Goddess Electra. He is not the first one to make the same error. Some people have got the notion into their heads that the old crude ways of using gas marked the limit of possible progress to this highly useful gift of Dame Nature to the world. "Dagonet" says a wonderful change has taken place of late years in London by night. He can look back upon a London which after nightfall consisted of a few patches of gas-lighted levity and lawlessness environed by areas of gloom. Regent Street, Piccadilly, and Oxford Street, after the shutters of the shops were up, were in semi-darkness. The Haymarket was the flaunting-place of vice and villainy; and one could be sand-bagged, robbed, or garrotted and robbed, in streets which are now a blaze of light the long night through. "The Goddess Electra," says "Dagonet," has given us "a London by night which is little short of marvellous to the middle-aged man who remembers the flickering gas-lamps of old." Let friend "Dagonet" walk this time observantly along Pall Mall, Regent Street, Piccadilly, St. James Street, Whitehall, and Victoria Street, as well as other thoroughfares, and he will see that gas (at high-pressure) as an illuminant has far outstripped the electric light in economy (the presence of the high-pressure gas-lamps may assure him of this), quality, and efficiency—efficiency that is put to the best test during the worst atmospheric conditions that prevail in the streets of the great Metropolis. Last Sunday, "Dagonet" made the necessary correction. It seems that he referred to the Goddess Electra as typifying "a shining light," and in that sense referred to both high-pressure gas and the electric light.

Labour Ambitions.

The Trade Union Congress which will open at Newport (Mon.) the first Monday in September will, according to the *agenda*, mirror the existing labour unrest and the political and social ambitions of advanced trade unionists, socialists, and syndicalists. Among the propositions that will be discussed is one in favour of trade unions taking early and simultaneous action to obtain an increase of 5s. per week in wages for all grades of time and piece workers in both public and private employ, ignoring altogether the questions of skill and class of work, and other considerations that usually regulate pay for labour. The same resolution also puts forward the old remedy for reducing unemployment—a forty-eight hour week, and limitation of overtime. Other resolutions ask for a minimum wage of 30s. per week for all adult male workers, and a forty-eight hour week, irrespective of sex. The Gas Workers' Union are responsible for a resolution proposing to instruct the Parliamentary Committee to draft a Bill for a general eight-hour day, to be introduced in Parliament without delay, and backed by a general agitation throughout the country. The Prime Minister, it is suggested, shall be approached with a view to the introduction of a Bill compelling employers to pay for all statutory holidays and all holidays subsequently proclaimed; while May 1 is wanted—presumably as a statutory holiday—so that the labour movement may have a day of its own. Syndicalism shows its fiery head. The congress is to be asked to express the opinion that the time has arrived when trade unions should refuse to work with non-unionists; and this in a "free" country! A little advice will be extended to those in authority in connection with the Insurance Bill. The list of resolutions shows a genuine and generous self-interest, and the impolitic plan of putting industry within cast-iron palings. If the aggregate of the ambitions of trade unions was consummated, *plus* the conditions already in existence, it would be a difficult question to decide who is the master and who the man.

Gas-Turbine Developments.

The gas-turbine has been so long before us, with no great amount of progress, that little hope of a practical success being obtained has survived the continued struggles of invention and experiment. At the same time, the workers in this field will not acknowledge themselves beaten. The excessively high temperatures that are generated in the turbine are at the root of the difficulty; and the destructive effect of these on the rotor of the turbines, and especially the blades, is of such a character that, unless something counteractive can be produced, then the gas-turbine remains in the field of impracticability. Naturally, under these circumstances, the lines on which work must proceed are to try to control the effects of the high temperatures, or to seek for a practicable material that will withstand the influence of temperatures common to gas-turbines—*i.e.*, round about 1500° or 1600° C., and even rising to 2000° C. Compare this with 400° C. in the steam-turbine! To attempt to find a metal that would resist such temperatures, and that could be used, would be futile; but in the former field there

are strenuous workers trying to achieve success in various ways. "The Times" reports on some German constructions, having in view the diminishing of the high-temperature effects. In the Holzwarth system, for example, the stream of hot gases introduced into the revolving parts is succeeded by a scavenging current of cold air to ensure a moderate temperature—the walls of the explosion chambers being exposed only for a fraction of a second to the high temperature gas. The inventor speaks hopefully and confidently of this; but it is doubtful whether the subjecting of the metal working parts to these rapid alternations of temperature would not have a deteriorating effect on the constructive details and parts, and would not attack detrimentally the efficiency of the turbine to such an extent that the question might well be raised as to whether the difference in efficiency between a gas-turbine and an ordinary internal combustion engine was worth the extra cost incurred in obtaining it. In the Holzwarth-Junghans system, a number of combustion chambers are arranged around the rotor; and they come into action successively. In this case cold air is used to sweep out the combustion chambers. There is also the system of the Deutz Gas-Motoren Fabrik in which high-pressure steam is employed to bring about a diminution of temperature. But the same argument applies. There are the high temperatures; and it is questionable whether the specifics proposed for their effects will not on the whole prove equally as bad. However, the work that is being done is interesting; but intelligence of practical application and of running experience is not available, and is not yet promised.

PERSONAL.

Mr. SAMUEL MOORE has relinquished his position in the Inspection Section of the Gas Department of the Belfast Corporation, on being appointed Secretary and Manager of the Dromore Gas Company.

Mr. JOHN MEADOWS FROST has consented to take the chairmanship of the Chester Gas Company, rendered vacant by the death of Mr. James Garrett Frost, and Mr. THOMAS GIBBONS FROST has been selected to fill the vacancy on the Board.

Mr. JAMES W. HELPS is at the present time at the seaside with Mrs. Helps and family. After this, following the advice of his doctor, he will take a sea trip—South Africa being his destination. We hope, with the host of friends he has in the gas industry, for good news in regard to his health as the result of the voyage.

It was mentioned in the "JOURNAL" for the 23rd ult. that Mr. H. M. THORNTON, Managing-Director of the Richmond Gas-Stove Company, had been made a Justice of the Peace for the County of Essex. Mr. Thornton's business career commenced with Messrs. Greenaways, of West Bromwich, and an appreciative notice of his subsequent work, terminating with hearty congratulations on the appointment lately conferred upon him, appeared in the "West Bromwich Chronicle" for the 9th inst.

We learn from the Secretary of the Continental Union Gas Company, Limited (Mr. W. Martin), that Mr. GEORGE ALEXANDER TOUCHE, M.P., has been elected to the vacant seat on the Board. The new Director is head of the firm of Messrs. G. A. Touche and Co., chartered accountants, of Basildon House, E.C., with branches in Montreal and Toronto, and of Messrs. Touche, Niven, and Co., of New York. He is also a member of the firm of Messrs. Deloitte, Plender, Touche, and Co., of Batavia, Java. Mr. Touche represents North Islington in the Conservative interest. He is a Freeman of the City of London, and is on the Livery of the Goldsmiths' Company.

Mr. FRANK E. COX, who is Assistant-Manager at the Tipton Gas-Works, has been appointed Assistant Gas Engineer at West Bromwich—under Mr. Harold E. Copp, the Engineer and Manager. Mr. Cox thus replaces Mr. A. O. Jones, who has gone to Manilla. Previous to the appointment, the Gas Committee interviewed seven candidates out of the large number who sent in applications for the position, and (a local correspondent reports), after careful consideration decided to give the appointment of Mr. Cox, who is a son of Councillor J. E. Cox, J.P., a prominent member of the West Bromwich Corporation. Mr. Cox, who is just over 20 years of age, holds "Honours" certificates in "Gas Engineering" and "Gas Supply."

In the last number of the "JOURNAL," reference was made to the appointment of the new Manager of the Maryport Gas-Works—Mr. CLARENCE HARRIS. In addition to the particulars then given, we learn that he was educated at the Wyggeston Schools, Leicester, and that while there he obtained honours in both the Junior and Senior Oxford Local Examinations. He was then for some years under his father, Mr. John A. Harris, the Manager and Secretary of the Great Wigston Gas Company. He next went to Messrs. W. C. Holmes and Co.'s, and finally returned to the Wigston Gas-Works, being appointed Assistant. While filling this position, he helped in the modernizing of what are now thoroughly equipped and efficient works; and he has also taken part in the rebuilding of other works. Mr. Harris was for three years prizeman in the science branch of the Leicester Technical School. His appointment as Manager at Maryport adds another member to the family group, which consists of the Managers of the gas-works at Wigston, Market Harborough, Padiham, Ashborne, Rothwell, Brigg, and Finedon.

Some of our readers may be aware that Mr. C. W. OFFORD, the General Manager and Secretary of the Enfield Gas Company, is the possessor of considerable musical ability, and is the Organist and Choirmaster at St. Mary's Church in the town. As in May last he had held this position for a period of thirty years, it was felt that something should be done to mark what must be almost a unique career; and therefore the gentlemen of the choir (on the initiation of Mr. T. Inglis) decided to present him with a token of their affection and gratitude. A number of the older members of the congregation were also invited to join in the testimonial, which was presented to Mr. Offord by the Vicar a short time ago in the presence of the subscribers. In making the presentation, which consisted of a silver teapot, cream-jug, and sugar-basin, the Vicar paid a high tribute to Mr. Offord's splendid work for St. Mary's, and expressed the hope that he would remain associated with it for many years longer. Mr. Offord having thanked the donors, Mr. Langton, the Vicar's Warden, added his tribute of affection and gratitude on behalf of the congregation.

Mr. CORBET WOODALL, the President of the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association, is taking a rest and holiday in Forfarshire. Reference to his absence, and to the work devolving upon him this and next year in the various official capacities he has been called upon to fill, was made at the meeting of the Croydon Gas Company on Friday last, by the Chairman (Mr. Charles Hussey, J.P.). The whole gas industry hopes that Mr. Woodall will return to London strong and well after his rest. His first public engagement then will be the inaugural annual meeting of the British Commercial Gas Association. Following will be the meeting of the Society of British Gas Industries; and not far ahead must come the chemical clause inquiry by a Joint Committee of the two Houses of Parliament. By the end of next June, Mr. Woodall will have had a unique experience of official headship in the gas industry. The cordial wish of everyone in the administrative and official ranks of the industry must be for an abundant success for services ungrudgingly rendered in the interests of the industry, and in celebration of the jubilee of its chief professional organization.

INSURANCE ACT AND GAS WORKERS.

Additional Decisions by the Umpire.

AMONG the recent decisions of the Umpire under the Insurance Act contained in the last number of the "Board of Trade Journal" are the following: Contributions are not payable in respect of workmen engaged wholly or mainly as painters in painting street-lanterns, or of workmen engaged in running gas-services from the main to the consumer's meter or in fixing gas-meters in houses.

National Insurance Act, 1911.

SIR,—The attention of the Committee appointed by this Association in conjunction with the Institution of Gas Engineers has been called to the apparent discrepancy between the portion of the Committee's report ["JOURNAL," July 9, p. 107] dealing with the applicability or otherwise of Part II. of the National Insurance Act, 1911, to workmen employed in laying gas-mains and the carcassing of buildings with gas-pipes, and subsequent decisions given by the Umpire.

The Committee, therefore, communicated with the Umpire upon the matter; and he has given a further decision—viz., that contributions are not payable in respect of workmen engaged in (*a*) running gas-services from mains to consumers' meters, and (*b*) fixing gas-meters in houses.

The Committee understand this further decision to be a confirmation of the statement made in their report, to the effect that contributions are only to be paid in respect of workmen employed in connection with the permanent piping of buildings.

FRED. E. COOPER, Secretary,
Gas Companies' Protection Association.

5, *Victoria Street, S.W.*,
Aug. 16, 1912.

Accounts of Water Undertakings.—It will be seen, from an announcement appearing elsewhere, that the "Analysis of the Accounts of Some of the Principal Water Undertakings of the United Kingdom" for the year 1910-11, compiled by Messrs. Wood, Drew, and Co., Chartered Accountants, is now ready. This is the thirty-first year of publication; and the nature of the work is well known to those of our readers who are connected with the management of water-works. Indeed, it may be safely stated that it is as valuable to them as "Field" is to their gas colleagues. The accounts dealt with are those of the Metropolitan Water Board for the two years ended March 31, 1910 and 1911, and of 23 Provincial water undertakings for the latter year. The "Analysis" is presented in the same form as its predecessors.

ELECTRICITY SUPPLY MEMORANDA.

Board of Trade and Speculation—Large Dependence of a Small Concern on One Consumer—The Intelligent and the Unintelligent of Kingston—A System of Charge from Germany—Portable Meters—Meter Testing.

ELECTRICAL people and municipal trading speculators are very upset with the Board of Trade for having refused their consent to the Newton-in-Makerfield District Council Electric Lighting Order. They object strongly to the Board exercising their jurisdictional rights in any way but the one that is favourable to the putting down of more and more electric plant—no matter whether or not success promises to attend it. The Board must not exercise any powers of discrimination that they may happily possess; and they must be perfectly oblivious to the fact that municipal electricity undertakings do not all pay, and that ratepayers have suffered heavily in consequence of speculation. The Board would forfeit all confidence if they hearkened to the voices of, and gave way to, the critics and agitators who hold that the Department ought never to exercise any discretion, or to stand in the way of municipal authorities who desire to have an electrical flutter with the remotest chances of permanent success. Lord Wolmer, as reported in the "Parliamentary Intelligence" last week, has lately raised his voice in the House of Commons in protest against the treatment of Newton-in-Makerfield by the Board. But every point he raised had been, it was found from the speech of Mr. J. M. Robertson, Parliamentary Secretary to the Board of Trade, anticipated by the Department. The Council had an Order granted to them in 1903. But they never exercised the power; and the Order was revoked. The Board have microscopically examined the position; and nothing of sufficient importance has occurred, in their opinion, to alter the view as to the speculative character of an electricity undertaking under the local conditions. The Council, through Lord Wolmer, plead that there is the Vulcan Foundry, the proprietors of which have promised to take 2 million units of electricity per annum from the local authority. There is nothing more dangerous than for a local authority of a comparatively small town to risk capital and the ratepayers' pockets in a business depending largely upon one considerable consumer. A consumer of the kind who knows his power is often a despot of the worst type. It is an unpleasantly frequent experience that such a consumer will grind-down prices in a manner that leaves nothing worth having; and if he cannot get the price in line with his own notions, then there is always the town-gas engine or the suction-gas plant maker, or the suppliers of Diesel engines ready and willing—aye, and quite eager—to show him how electricity can be generated by a private plant at a lower cost than that at which it can be supplied by the town authority.

That is an important consideration; it shows the unstable ground upon which stands a concern in the condition of large dependence upon a single consumer. That dependence makes the small concern still more speculative. There is no moderation of the fact as to speculation in the suggestion that the generating costs of central stations have been reduced in modern times. If they have been reduced for a small central station, they have been reduced for a private plant—and much more so, seeing that the latter has not to bear distribution costs and other expenses attaching to the central station service. Moreover, Lord Wolmer and his like ought not to forget that the reduction of generating costs brought about by an established concern doing a respectable business is not a condition into which a new concern can walk immediately at its birth. It would really be interesting to hear Lord Wolmer's explanations as to the way that electricity generation has been cheapened in recent years. Perhaps some one has been telling him of the Diesel engine, which somehow or other got a reputation for working miracles in this connection until central station engineers found out that fuel costs do not sum up all the expenses involved by this type of engine. However, it was not diplomatic on Lord Wolmer's part to let "the cat out of the bag" in the course of his speech. According to him, what the Newton-in-Makerfield Council have their eyes upon is mainly this, that if there is any profit to be made from electricity supply, they may as well have it, rather than a private company. His Lordship did not look at the matter from the other side of the hedge, as had the Board of Trade. If there is any loss to be made, then, better private speculators bear the loss than the ratepayers through the folly of their governing body. Another factor that the Board of Trade see will militate against success for a small electricity station is the cheap gas supply. The Board of Trade are right in standing between the ratepayers and speculation by the Council. Many ratepayers in many towns could sincerely wish the Board had performed the same service for them years ago.

"Electrical Industries" has been telling its readers why the Kingston-on-Thames Electric Light Department cannot inform the ratepayers the reason that one tradesman in the town should have preferential treatment in the matter of price for electrical energy over all others, nor what are the conditions on which the preferential price is granted. Presumably, the readers of "Electrical Industries" did not really know previously the cause of the reticence of the Kingston Electricity Department; and the ratepayers of the borough who are taking such a keen interest in the affairs of the municipal trading concern, which has made deep inroads upon their private purses, will feel somewhat humiliated when they learn the view of our contemporary. It is simply this, that "the calculations which go to the settlement of a flat-rate for a certain complex demand are rather more intricate than a Kingston burgess could readily grasp." And added to this our contemporary considers it a questionable policy to expose to public criticism every detail of a consumer's demand. Take the former part of this statement first. What it really means is that the Committee who had the settling of the terms of the contract, and who are themselves Kingstonians, are far more intelligent than their fellow ratepayers. They evidently can readily grasp "the calculations which go to the settlement of a flat-rate for a certain complex demand;" but their superlative intelligences assure them that the numskulls and plebeians who are their fellow burgesses would not appreciate the mathematical works of art which they profess to understand, and ought to understand, and which are said to be requisite before fixing the price to be paid by consumers who require special consideration. The infinitesimal differences in demand that justify wide variations being made in price by Committeemen with mathematically swollen heads are shown by the statement of "Electrical Industries" that "*slight shades* of difference in demand and in location which have so much effect on the cost of supplying certain consumers, are invisible to the consumers themselves." Fancy shades so slight that they are invisible to ordinary mortals having such big effects!

Now we do not think the good burgesses of Kingston desire to know particularly the detail of this favoured consumer's demand or about the conditions on which he is supplied at a lower rate than other people. The ratepayers are told that the contract is in the best interests of the ratepayers. They are anxious to have something more than the bare statement; they are desirous of having the evidence that this consumer and the Electric Lighting Committee—all of whom are fellow ratepayers—have in their possession, so as to satisfy themselves and, if satisfied, so as to be able to rejoice with those who have done something at last in connection with the supply of electricity in the borough that is really in the best interests of the ratepayers. They are also told that any other ratepayer offering similar conditions of supply as this favoured consumer can have electricity on the same terms. Naturally, this tradesman's rivals—probably less opulent rivals—cannot tell whether there is any chance of them complying with the conditions until they have been allowed to make their acquaintance. This difficulty at Kingston shows a distinct objection to a trading concern being run by a local authority, which local authority is composed of ratepayers whose position as such is, more likely than not, of less importance than that of many of the ratepayers outside the body municipal.

The home electricity industry not having sufficient methods of its own for charging for electricity, the "Electrician" has introduced to it one from Germany. But it does not appear to be a very distant relation of some of the methods that have been tried in this country—and in most cases have been found wanting, and in others have only secured limited success. The so-called new system, which is credited with having obtained much success in Germany, is the contract-one; and conjoined to its sweet simplicity is a limiter, which prevents the consumer taking more than his prearranged maximum quantity of current, for which prearranged maximum he pays a prearranged sum. Up to the maximum quantity, he can presumably use electricity how and when he likes. Our German cousin has been brought up in the lap of strict military discipline; and so he is not at all surprised when the cut-out sets to work, calls a halt, and orders him to go no farther in his consumption of electricity. One advantage of the limiter is that it does away with all spying on the part of the central station officials. But the advantage—and it is about the only one—that our friends at home see in it is that it does away with the electric meter, with all its faults and expense, and all the incitement it gives for quarrelling between the electrical officials and the consumer. Another good effect that the philosophic mind of the "Electrician" sees in it is a moral one—it "removes suspicion and uncertainty from the mind of the intending consumer." We question that as applied to this country, though not daring to suggest anything to the contrary so far as our German friends are concerned. When the limiter comes into operation in this country, most consumers would have the suspicion that it was exercising its functions a bit too early, and had a greater partiality for the interests of the central station than for those of the consumer. The fundamental application of the system can be varied in several ways—such as upon kilowatts installed, maximum demand, number and size of lamps, position of lamps on the premises, and, of course, arrangements can be made for an unlimited supply, at a price. There is an advantage in a variety of bases; inasmuch as, the more variations there are adopted, the less chance there is of consumers having rigid conditions on which to compare notes as to their payments. With maximum cut-outs, the price secured for lighting in Germany appears to be, on an average, £17 17s. per kilowatt-year; and per horse-power-year for power, £9 17s. How much business is there to be done is this country among those who are not yet electricity consumers for lighting at £17 17s. per kilowatt-year? However the "Electrician" thinks that the idea is worth consideration by those central station engineers whose brains have not been already sorely vexed by the numerous systems that have been proposed with the view to find something more productive than the one in use. But they are always reduced to this fact, that no system can be counted successful that does not supply sufficient revenue for capital charges, for all outgoings and something to put by for a rainy day, as well as for

depreciation. The expediency of adopting a system for the purpose of catching new consumers is not the first nor is it the last consideration.

Speaking of charges reminds us that the lump-sum-down method of charging, with a subsequent charge of 1d. or ½d. per unit for all electricity consumed for any purpose, does not appeal to the ordinary householder with the slender purse. There has, therefore, been further talk recently of sub-meters, in order to do away with the necessity for duplicate wiring. The best of meters, however—that is to say, those that are most truthful—cost most money; and cheap and nasty sub-meters would be a fruitful source of disturbance of the equanimity that it is always preferable should exist beween buyer and seller. The objection to using the ordinary electric sub-meter is that one is required in every room where the current is taken off the lighting circuit for other purposes. This means money. But Mr. Bastian—a name associated with an honourable little discussion that took place in our columns over a heat storage box, which was going to revolutionize the electricity business, and has neglected to do so yet—has, or his Company have, overcome the difficulty. What can be more simple than a portable sub-meter? The Company have introduced one, which can be carried from room to room. Supposing Mrs. Brown wants an electric-radiator in use in her drawing-room, she has only to fix the portable meter there. Supposing a servant wants to use an electric-iron in the kitchen while Mrs. Brown has the radiator on, then it is only a question of "tossing up" to see who is to have the portable meter. Supposing the cook wants the portable meter at the same time, then there will be a repetition of some of the recent dock scenes. There is no question about it, the business of the electricity industry does lend itself to a myriad of variations. No electrical engineer ought to want a summer change on the score alone of a want of variety.

The London County Council have given notice of a new set of rules and scale of fees for testing electric-meters. The rules and fees are subject to the approval of the Board of Trade. From the rules, it is seen that for meters in which the maximum current for full load does not exceed 3 ampères, the error at any point from one-tenth load to full load must not exceed 3½ per cent. *plus* or *minus*. For meters in which the maximum current for full load exceeds 3 ampères, but does not exceed 50 ampères, the error at any point from one-tenth load to full load must not exceed 2½ per cent., *plus* or *minus*. For meters in which the maximum current for full load exceeds 50 ampères, the error at any point from one-twentieth load to one-tenth load must not exceed 2½ per cent. *plus*, and at any point from one-tenth load to full load must not exceed 2½ per cent., *plus* or *minns*. The fees for testing in batches of not less than ten range from 6s. 6d. to 9s. per meter—maximum prices—according to construction and requirements. Reductions or special arrangements are made for larger quantities. The delicate constitution of electric-meters is such that, after they have been tested, and have undergone a journey, in all probability they will have contracted some disorder before being established on the consumers' premises. The County Council in their scale of fees thoughtfully provide for subsequent inspection *in situ* after the fixing of the certified meters. For this service 2s. 6d. per meter is charged; or an inspector's services can be had for a day for £1, or for half a day for 15s. For testing disputed electricity meters up to 20,000 watts capacity, the eharge is 10s.; and by 10s. gradations we mount up to £2 10s. for a meter of from 80,000 to 100,000 watts capacity. This is an incidental expense of which consumers do not approve.

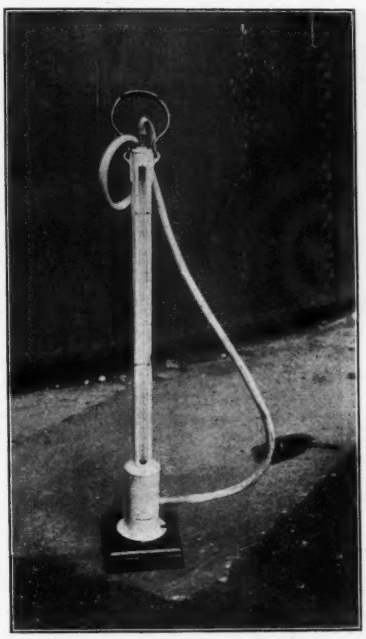
"Transactions" of the Belgian Gas Association.

We have received from the Secretary of the Belgian Association of Gas Managers (M. Van Heede) the "Transactions" for the session 1911-12. The pamphlet contains the report of proceedings at the annual general meeting, held in Brussels on the 14th of June, under the presidency of M. Brender à Brandis, of Antwerp. In the course of a short address, the President referred to the exhibition of 1910, the results of which, he said, were not purely material. The exhibition was the *rendezvous* of engineers and gas men from every part of Europe; and among the visitors he mentioned specially those from England, France, and Holland. The technical matter consists of the following papers: "A New Gas-Heated Bakers' Oven," by M. Marcel Nicaise; "The Rapid Laying of a Trunk Main across a River," by M. Auguste de Brouwer; "The Application of Coke-Oven Gas to Lighting Purposes in Belgium," by M. Gasp. Coune; "The Klonne Horizontal Chamber Settings at the St. Gilles Gas-Works," by M. Timmermans; and "Gas Calorimetry," by M. Maurice Schindeler. Following the papers is a reprint of an article on "Calorimetric Chambers," communicated by M. Grebel to the "Journal de l'Eclairage au Gaz." The papers are illustrated by plates, among them being a large coloured one of an Evence-Coppée coke-oven. The other matter in the pamphlet consists of a list of the officers and members of the Association for 1912-13 (the honorary ones being MM. Aerts, J. de Brouwer, and H. Salomons) and the accounts. The latter showed that on the 1st of June there was a balance in hand of 11,955 frs. (£478).

At the Maitland Hotel, Edinburgh, the marriage recently took place of Mr. W. M. Wilkinson, the Manager of the Penicuik and District Gas Company, and Miss Jessie Isabella M'Donald, fifth daughter of the late Mr. Donald M'Donald.

GAUGE FOR TESTING HIGH-PRESSURE MAINS.

Last April, Mr. David W. Sugg (who is now engaged with the Brentford Gas Company) applied for a patent—No. 9428, April 20—for a single-tube high-pressure mercurial gauge; and he has sent a photograph of the arrangement, which is reproduced.



Concerning it, Mr. Sugg writes: The gauges are at present being made in the Brentford Company's workshops, and are used in the district by the Superintendent of Mains for testing the high-pressure mains for soundness. Previous to this, ordinary U-tubes, mounted on a board, and charged with mercury, were used—in the manner of an ordinary wall pressure-gauge. Frequent breakages, with consequent loss of mercury, occurred, as well as the time of a man returning to the works for a fresh tube of mercury. The gauge I have devised is pronounced by our Superintendent to be more reliable and sensitive than anything he has used—including dial gauges. Furthermore, it is portable; and if knocked over, the loss of mercury is prevented by a simple device in the inlet tube and the top of the barometer tube. The area of the cistern, as compared with the bore of the glass tube used, is so many times greater that the difference in level of the mercury in the cistern from zero to the top of the indication—*i.e.*, 20-inch columns of mercury equal to 10 lbs.—is only 1 mm., which is a negligible quantity when arranging the scale on the instrument. It is also used as a wall gauge, where we work at great pressures; and then a slight difference is made in the construction to show zero on the glass, instead of it only being marked on the casing. The Brentford Gas Company are making the gauges to show a pressure of 20 lbs. to the square inch.

Illuminating and Calorific Power of Gas.

An interesting pamphlet, bearing the above title, has just been issued by the Belgian Association of Gas Managers, and a copy has been forwarded to us by the Secretary (M. Van Heede). Early in the year, a resolution was passed at a full meeting of the members, to the effect that—in view of the comparatively secondary value of the illuminating power of gas, as compared with its calorific power, under the present conditions of use—it would be to the general advantage if, in existing and future concessions, the clause relating to illuminating power were replaced by one specifying for calorific power, and that this should be fixed at 5100 calories per cubic metre, or about 570 B.Th.U. gross per cubic foot, as measured by the Junkers calorimeter, with an allowance of 5 per cent.—the gas to be dry and brought to a temperature of 32° Fahr. and 30 inches barometer. It was further decided that, where it was desired to retain the test for illuminating power, the No. 2 "Metropolitan" burner should be substituted for the bengel or argand burner hitherto employed; the latter "not being in accordance with exact scientific principles." These decisions are given at the front of the pamphlet; and they are followed by a number of documents which are quoted in justification of them. They consist of extracts from concessions, and from papers and communications bearing upon the subject which have been submitted to various Societies. In fact, the pamphlet may be regarded as a collection of evidence in support of the changes suggested in the resolution—the portions of special value being printed in very heavy type, so as to catch the eye. The Belgian Association deserve thanks for producing it.

THE NEW GASHOLDER AT MANCHESTER.

ASHMORE, BENSON, PEASE, AND CO., LTD., Contractors. J. G. NEWBIGGING, M.Inst.C.E., Engineer.

NEW GASHOLDER, TEN MILLION CUBIC FEET CAPACITY, AT BRADFORD ROAD (MANCHESTER) GAS-WORKS.

THE new gasholder erected at the Bradford Road station of the Manchester Corporation by Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, is now practically completed; and the formal opening and bringing it into use will take place in October. Through the courtesy of Mr. J. G. Newbigging, M.Inst. C.E., the Chief Engineer of the Manchester Corporation Gas Department, we are able to reproduce a photograph of the holder as it now appears.

At different times during the period the work has been in progress particulars have appeared in the columns of the "JOURNAL" in regard to this large holder, and also the tank. It is therefore only necessary now to give sundry memoranda of the work being completed. Readers who desire further details will find them in a paper read by Mr. J. G. Newbigging before the Manchester Institution of Gas Engineers in February, 1909, reported in the "JOURNAL" for March 2 of that year, and also in a paper prepared by his Assistant, Mr. Frank H. Robinson, and published in the "JOURNAL" for Dec. 13, 1910.

It was in July of 1908 that the foundation stone-laying ceremony took place; the late Alderman Gibson, as Chairman of the Gas Committee, having been asked to carry out the chief part in the day's proceedings. Following this event there was considerable delay in proceeding with the construction of the tank, in consequence of the extensive investigations which had to be made by Mr. Newbigging as to the coal-mining operations carried on underneath the site of the structure, and any possible effect that might arise therefrom. After this important matter had been dealt with satisfactorily, work was proceeded with, and has gone on continuously ever since. The holder is the third largest in the world; having a capacity of 10,410,000 cubic feet. Though not quite the largest in the world, it is probably the heaviest of its kind. The whole work was designed by the Chief Engineer. The following are the principle features of the undertaking.

Tank.—Size of tank, 285 feet in diameter and 43 feet deep. Excavation for tank walls, &c., 107,000 cubic yards. Clay puddle, 7940 cubic yards. Number of bricks required for tank, 4,000,000. Thickness of tank wall, 5 ft. 6 in. at the base, and 2 ft. 9 in. at top. Stonework, 10,225 cubic feet. Timber used in excavation to keep the ground intact until the walls were being built: Polling boards, 89,500 superficial feet by 1½ inches thick; walling timbers, 14,660 cubic feet; struts, 18,330 cubic feet; punchings, 3000 cubic feet. Total depth of excavation in trench, 50 feet. Total depth of excavation in pipe recess, 56 ft. 9 in. Total weight of steel and iron work in tank framing, 258 tons. Water required to fill tank, 9,042,018 gallons. Cost, £35,638.

Holder.—Outer lift, 282 ft. diameter by 42 ft. 6 in. deep; third lift, 279 ft. by 42 ft. 6 in.; second lift, 276 ft. by 42 ft. 6 in.; inner lift, 273 ft. by 43 ft. 6 in. Total capacity of holder, 10,410,000 cubic feet. Ground level to top of holder crown, 182 feet when filled. Ground level to top of guide-framing standards, 169 ft. 6 in. Steel standards and guides, 32 in number, each weighing 30 tons complete. Floating weight of holder, 1607 tons. Total weight of steel and ironwork in holder complete, 3080 tons (excluding the tank framing, previously given). Estimated cost of holder, with tank framing and inlet and outlet pipes, £52,600.

With regard to the investigations made as to the coal workings, Mr. Newbigging says: "The strata revealed by the excavation fully confirmed the earlier investigations made with the boreholes. The whole of the ground was solid, and showed no signs of subsidence or damage from coal workings. The fact that underneath the site of the Bradford Road works is undermined, and it being known that shallow seams of coal had been worked in the vicinity of the tank about the end of the Eighteenth Century, rendered it necessary that more definite information should be obtained with regard to the position of these before the building of the tank wall was commenced. In order to ascertain if any of the shallow seams of coal had been sufficiently near to the base of the tank to be likely to cause damage to the structure, headings were driven from several points in the bottom of the tank excavation in a lateral direction for a distance of 30 or 40 feet. On examining the strata revealed by these headings, no indication was found that there was any danger to be apprehended to the tank from the working of the shallow seams of coal; so the headings were filled up with concrete tightly rammed and the construction of the tank was at once commenced."

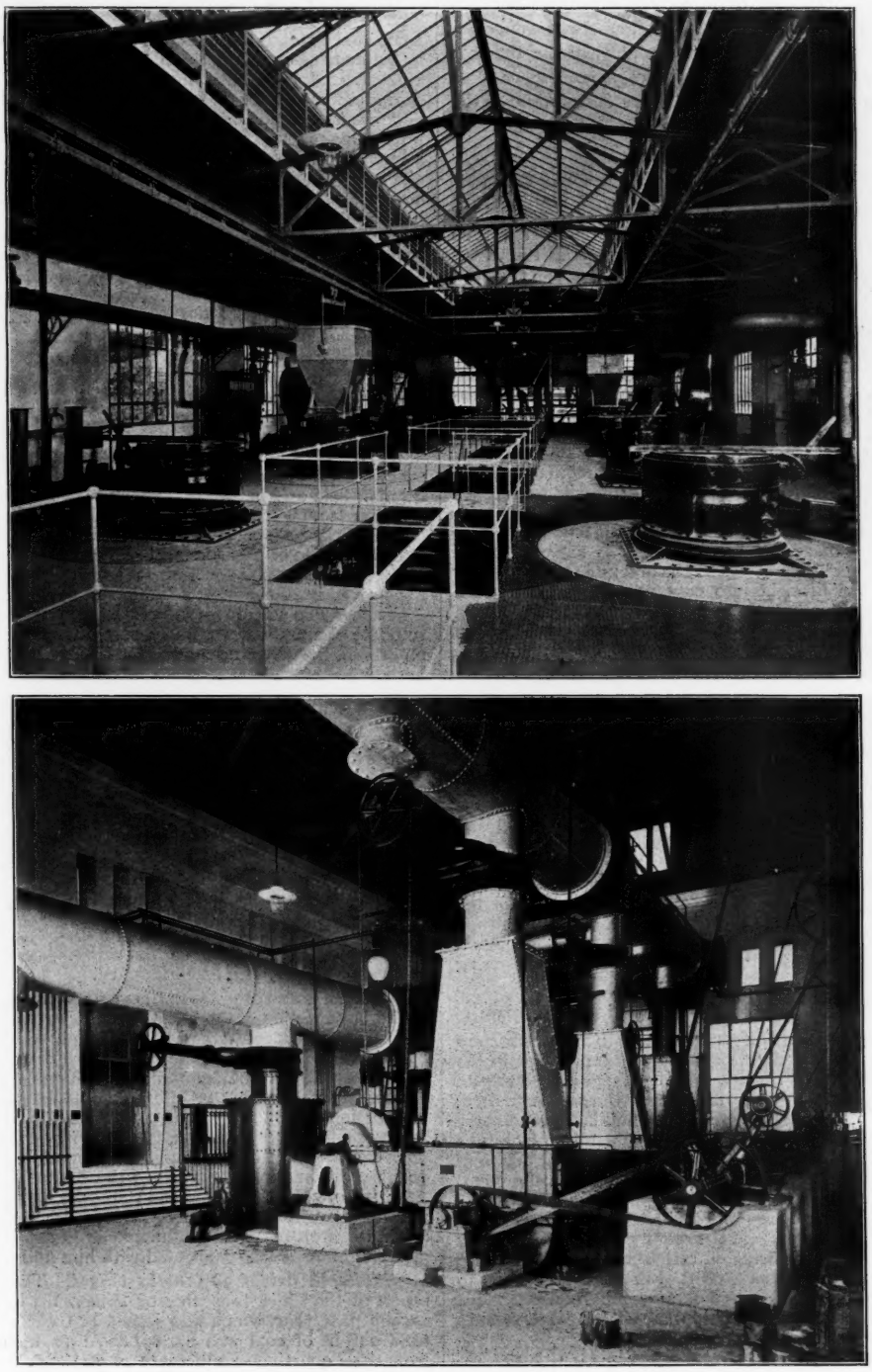
Explosions in Prussian Coal Mines.—A recently issued report states that in the year 1910 there were 41 explosions of fire-damp in Prussian coal mines, of which eleven were responsible for the deaths of 33 persons. The other explosions were without fatal results, though many men were injured by them. The numbers are higher than in the previous year, though lower than the annual average for the decade. The majority of the explosions took place in the Dortmund statistical district. Two men were asphyxiated by fire-damp (? black damp) in the course of the year; but no explosions from coal dust alone were reported.

THE KERPELY GAS-PRODUCER.

The Vienna Installation.

In the course of the article on the new gas-works at Vienna which appeared in the "Journal" a fortnight ago (p. 385), reference was made to the installation of the above-named producers. The circumstances which led to the adoption of the producers, in conjunction with Koppers horizontal carbonizing chambers, were set forth in an article in the "Journal" for the 23rd of April last (p. 231), in which a description was given of the plant. The size of the installation at Vienna, and the general satisfaction it has given—as shown by the fact that the first installation of four led to an order for sixteen more—have aroused attention; and therefore the accompanying illustrations of the producers, and the following particulars in regard to them, supplementing those which have already appeared, may not be without interest.

The outstanding features of the Kerpely producer are that it effectually gasifies low-grade fuel, coking or non-coking, and deals with the entire charge without leaving the usual mixture of ashes with a great deal of coke. It has a revolving mechanical grate, consisting of a single oblong and spherically shaped cone fixed eccentrically upon the water-trough, and provided with a nearly flat oblong-shaped top, which keeps the carbonic acid zone as low as possible. By the continuous revolution of the grate, the supply of air and steam is efficiently dispersed over the whole area of the fuel bed. The producer is furnished with a water-cooled jacket,



The Kerpely Producer Plant at the Leopoldau (Vienna) Gas-Works.

which prevents clinkers adhering to the walls; thus leaving the entire area of the producer free for the production of gas, which is found on analysis to be of unvarying quality and constant calorific value. It enables any furnace with which it is connected to work smoothly and equally, and thus ensures uniformity of production. In an ordinary gas-producer, the ash has to be raked out; whereas the Kerpely producer is fitted with an automatic ash discharge, which allows of continuous working with a minimum expenditure of labour.

These, briefly stated, are the features of the Kerpely producer which commend it to the notice of gas engineers and others. Fuller details in regard to it, as well as the results of tests of its working at Vienna and elsewhere, are contained in a pamphlet recently issued by the agents, Messrs. E. G. Appleby and Co., of No. 10, Victoria Street, S.W. The claims made for it are that it secures a saving in first cost, in working expenses, and in coal; its average consumption of coke breeze being 11 lbs. per 100 lbs. of fuel carbonized. In the report on the trials at Vienna, it is stated that during the entire period over which they extended the working of the producer was excellent. The fire was regular and did

not require stoking; and the depth of the fuel bed was normal. The pamphlet referred to contains numerous testimonials to the efficiency of the producer; and the statements are borne out by the fact that upwards of 600 of these appliances are now, we are informed, in successful operation in all parts of the world, while the number ordered is upwards of 700.

SULPHATE OF AMMONIA AS A FERTILIZER.

ITS ACTION AND NUTRITIVE PROPERTIES.

By Almea.

Although the majority of gas engineers and managers have an intimate knowledge of the manufacture of sulphate of ammonia, they seldom follow the question further, and investigate the uses and nutritive properties of their valuable bye-product when used as a fertilizer. In view of this fact, a short description of the functions performed by this salt as a manure will probably not be out of place in the pages of the "Journal."

Primarily, sulphate of ammonia is a manure valuable solely for its nitrogen, and is classed as a "special" manure—that is to say, it is a manure which supplies a particular food (nitrogen) which is specially required to enable the plant to flourish. It is thus distinct from the "general" manures which supply all the necessary plant-foods. It is an excellent fertilizer for corn crops, potatoes, and swedes; and its uses extend to numerous other necessities, such as rice and cane sugar.

Of the ten elements which are presumed to be essential to the growth of plants, nitrogen is one; and it occurs chiefly in the albuminoid constituents of the plant, together with a small proportion of sulphur. The roots of a plant, in addition to absorbing water from the soil, take up various soluble salts contained in this water, and supply the plant with nitrogen which is taken up in the form of nitrates. Moreover, the plant is also capable of making use of nitrogen when in the form of ammonia or nitric acid. Although the soil receives a certain amount of natural enrichment, furnished by nitrogenous organic compounds, the losses of nitrogenous matter generally exceed the gains, and consequently some form of artificial nourishment is essential if the best results are to be obtained. It has been found that a manure is effective only when brought into contact with the roots of a crop; and soluble manures, such as sulphate of ammonia, have a great advantage in that they distribute themselves evenly within the soil after the first heavy shower, although the best results are generally obtained when the salt is ploughed or harrowed in.

Nitrification.

The nitrogen contained in the soil is not in a condition to serve as a food in that form, but is first converted into ammonia compounds; and from these compounds the nitrates are produced. In cases in which nitrogen emanates from organic matter and fertilizers containing organic nitrogen—such as Liebig's bone meal—the change is effected by numerous varieties of fungi and bacteria, and conversion into nitrates and nitrites occurs as soon as the earlier stages of decomposition set in. With artificial sources of nitrogen—and under this head comes sulphate of ammonia—the process, however, differs; and the conversion of the ammonia into nitrates can only take place when some strong base, such as lime or chalk, is present to neutralize the acids, the ammonia being oxidized into nitric acid and the acid acting on the base to form a nitrate—thus:

$$2NH_3 + CaO + 8O = 3H_2O + Ca(NO_3)_2 \text{ [nitrate of calcium]}.$$

This process of the conversion of ammonia into nitrates is commonly called "nitrification," and is a fundamental principle in the science of fertilization. Nitrification usually takes place after an interval of a few days from the time when the soil is treated, although it is greatly retarded when the ground is unusually dry and the weather fine. In addition, it will only take place in a moist soil sufficiently porous to admit air, and is most active at summer temperatures, practically ceasing near the freezing point. If a soil is deficient in basic substances, the nitrification will be much delayed; but the difficulty may be overcome by the application of lime in the autumn. On the other hand, if sulphate of ammonia is used as a top-dressing on soil which contains a large proportion of calcium salts some portion of the ammonia is apt to be lost from the volatilization of ammonium carbonate. This loss can be diminished by mixing the sulphate with superphosphate and applying in showery weather.

Advantages of Sulphate in Wet Seasons.

A great disadvantage attending the use of soluble nitrates is that in abnormally wet seasons, such as have prevailed in recent years, the salts are likely to be washed past the range of roots and completely wasted. The loss of nitrates in this way may be very considerable, as they are washed into the subsoil, along with other salts, and escape into the rivers and brooks. In some cases where the fertilizer has been thickly scattered, the loss will amount to several hundred pounds of salt per acre. In this direction, the great superiority of sulphate of ammonia is evident from the fact that no loss takes place during a wet season, for the salt is definitely fixed in the soil until it undergoes nitrification, and, in consequence, it continues to nourish the plant for its whole period of growth and assimilation. In the crystallized form, sulphate of ammonia is the most highly nitrogenous of all the manures at the disposal of farmers; but care should be taken to see that it contains no ammonium sulphocyanide, as this compound is decidedly injurious to plant life. To determine whether or not this impurity is present, a small quantity of the sulphate should be dissolved in water and a little ferric chloride and nitric acid added. If the sulphocyanides are present, the solution will change colour to a deep red.

Nitrate of Soda as a Competitor.

Sulphate of ammonia as a fertilizer finds its greatest competitor in nitrate of soda, of which an enormous deposit is found in Peru. The nitrate, when it arrives in this country, has been purified by crystallization, and contains from 15 to 16 per cent. of nitrogen. The return from the use of sodium nitrate is said to be generally somewhat greater than the use of the same quantity of nitrogen as sulphate of ammonia; and while the nitrate is distinctly more efficient in dry weather, the ammonium salt has the advantage during a wet season. The nitrate is more rapid in its action than any other nitrogenous fertilizer, and is therefore employed in preference to sulphate of ammonia when a late dressing has to be given. Inferior qualities of nitrate usually contain potassium perchlorate, which has an injurious effect upon cereal crops. The somewhat general use of soot as a manure is due to the fact that it contains from 2 to 3 per cent. of sulphate of ammonia and other ammonium salts.

In the year 1897, the Sulphate of Ammonia Committee was formed to inquire into the great depression in the market at that time and to set forth the advantages attached to the use of sulphate as a manure. The Committee received the support of the majority of sulphate manufacturers, and has since done admirable service to the industry in carrying out practical tests to demonstrate the superiority of sulphate. Special plots have been cultivated; and to encourage the use of this fertilizer, prizes and cups are awarded for the best results obtained with it.

In 1907, Mr. John Hunter, the Technical Adviser to the Committee at that time, stated in his annual report that "from every experimental station at home and abroad there had come a repetition of field and plot results which all go to prove that organic nitrogen from Peruvian guano or sulphate of ammonia is invariably superior to inorganic nitrogen in nitrate of soda, nitrate of lime, or nitrate of potash, and that where these sources of organic nitrogen have been tested against each other, sulphate of ammonia has proved itself the most reliable and economical."

Readers who wish to go more closely into the individual uses of sulphate of ammonia will find a host of information in the yearly reports of the Committee, extracts from which are to be found in the "Journal."

German Gas Coke.—According to the "Iron and Coal Trades Review," the Association of German Gas-Works, of Cologne, have induced the larger gas coke merchants of Berlin to form themselves into an Association, with a capital of £28,080. They have further made arrangements for an export warehouse on the North Sea, and have come to an understanding with the French and Belgian gas coke syndicates to regulate the traffic in coke across the frontiers. The Paris coke and the German coke, accordingly, no longer interfere with each other. The prospective quantity of coke to be dealt with during the year 1912-13 is 595,634 tons—342,125 tons through the Cologne and 253,509 tons through the Berlin office; and it is stated that within a very little these quantities have already been sold forward.

William Murdoch's Association with Redruth.—It was reported at the last meeting of the Redruth District Council that the bust of William Murdoch which had been presented to the town by Mr. R. Barclay Murdoch had been broken in transit to Redruth, and it was decided to communicate with the donor. A writer in a local paper suggests that efforts should be made to save from destruction the house in which Murdoch lived at Redruth—the first to be lighted by gas. It is pointed out that, in addition to its association with Murdoch, the house is of interest, for it occupies the site and was built of the materials of the chapel of St. Rumon, which was erected in 1405 for the use of pilgrims to a neighbouring shrine. Murdoch occupied the house for 19 years, and it might, it is suggested, be made the home of an interesting museum more or less connected with him and his inventions.

Increased Output of Coal Last Year.—The first part of the report of the Chief Inspector of Mines (Mr. R. A. S. Redmayne) for the past year, which was issued last Friday, shows that the total output of coal was 271,891,899 tons, including 13,775 tons from open quarries—an increase of 7,458,871 tons upon the previous year, and the greatest output yet recorded. Every district showed an increase; the amount being: Scotland, 383,031 tons; Newcastle, 2,156,190 tons; Durham, 1,814,303 tons; York and North Midland, 1,195,176 tons; Manchester and Ireland, 25,075 tons; Liverpool and North Wales, 227,055 tons; South Wales, 1,500,745 tons; Midland and Southern, 157,296 tons. Mr. Redmayne remarks that the chief causes which contributed to the increase were probably briskness of trade (shown by the increase in the number of persons employed) and comparative freedom from strikes. Another contributory cause was the fact that the question of a national strike of coal miners was under discussion, which conduced to much greater activity in the coal trade during the latter half of the year.

MELTING POINTS OF FIRE-BRICKS.

The "Journal of the Franklin Institute" for the current month publishes an abstract of a "Technologic Paper" shortly to be issued by the Bureau of Standards at Washington. It deals with the melting points of fire-bricks, and is by Mr. C. W. Kanolt.

He says: We are accustomed to thinking of a melting point as a temperature at which a substance changes from a rigid to a fluid condition; but a melting point can be precisely and rationally defined only as the temperature at which a crystalline or anisotropic phase and an amorphous or isotropic phase of the same composition can exist in contact in equilibrium. While this definition is satisfactory for pure substances, so complex a mixture as an ordinary fire-brick usually has no single definite melting point according to this definition; since several anisotropic phases may be present, all differing in composition from the isotropic phase produced by fusion. We can then only select the temperature at which the transition from a rigid to a fluid state seems most distinct, and can call this the melting point only by apology. In the case of fire-bricks, the transition temperatures so found are, fortunately, sufficiently distinct. I have taken as the melting point the lowest temperature at which a small piece of the brick could be distinctly seen to flow.

The experiments were conducted in an Arsem graphite resistance vacuum furnace. The samples were usually enclosed in a refractory tube made of a mixture of kaolin and alumina in the proportions to form sillimanite, to protect them from the small amount of reducing gas in the furnace, although the action of this gas was slight. The samples were observed through a glass window in the top of the furnace.

The temperatures were determined by means of a Morse optical pyrometer of the Holborn-Kurlbaum type, which was sighted vertically downward through the glass window. The carbon-filament pyrometer lamp was calibrated by two methods. In the first calibration it was sighted into a platinum resistance furnace in which black-body conditions were obtained, and the temperature of which was measured by platinum platinum-rhodium thermo-couples. These thermo-couples had been calibrated against the freezing points of pure metals. In the second calibration, the lamp was calibrated against the freezing points of metals directly, without the intermediation of thermo-couples. The metals used were copper, silver, and the copper-silver eutectic, which freeze at 1083°, 961°, and 779° respectively. The metals were melted in the vacuum furnace in graphite crucibles; the pyrometer being sighted into a thin-walled graphite tube inserted in the metal. The pyrometer readings corresponding to the freezing points were determined by means of cooling curves.

As the melting points to be measured were above the working limit of the pyrometer lamp, an absorption glass was interposed between the pyrometer and the furnace. The true temperatures were then found from the apparent temperatures measured through the glass, by means of the equation

$$\frac{1}{T_2} - \frac{1}{T_1} = A,$$

Where T_1 is the absolute temperature of the furnace; T_2 is the apparent temperature observed through the glass; and A is a constant. The value of A was determined by calibrations at various temperatures. A small correction was also applied for the absorption and reflection of the glass window of the furnace.

The samples, which were from one to two centimetres in diameter, were heated at the rate of about 10° per minute when near the melting point. It was found that in the case of certain bricks made of heterogeneous material of relatively low melting point, the melting points were slightly higher after six hours' heating to 1550° —apparently as the result of the gradual running together of dissimilar particles to form a mixture having a higher melting point than the most fusible of the original materials.

The results are summarized in the following table:

Material.	Number of Samples.	Melting Point, Centigrade.
Fire-clay brick	41	1555° to 1725° mean 1649°
Bauxite brick	8	1565° to 1785°
Silica brick	3	1700° to 1705°
Chromite brick	1	2050°
Magnesia brick	1	2165°
Kaolin	3	1735° to 1740°
Bauxite	1	1820°
Bauxite clay	1	1795°
Chromite	1	2180°
Pure alumina		2010°
Pure silica		1750°

The value 1750° given for silica is not the true melting point, but represents approximately the temperature at which the silica flows distinctly. It was found that silicon carbide does not melt below 2700°; it becomes unstable at much lower temperatures.

Dealing, before the Paris Academy of Sciences, with the subject of the application of luminous energy to the study of some questions of chemical analysis, M. Marc Landau says prolonged exposure to ultra-violet light completely polymerizes ethylene; but methane, ethane, and hydrogen undergo no change under the same conditions. These facts can be applied in the analysis of gaseous mixtures.

CHEMICAL CONTROL OF WATER-GAS PLANTS.

At the last Annual Meeting of the Illinois Gas Association, a paper on "The Application of Chemical Control to the Operation of Water-Gas Plants" was submitted by Mr. G. W. Wallace. It consisted of data obtained, over a period of four years, from the analyses of gases from several carburetted water-gas plants, and the particulars collected were used as a means of arriving at the proper way of controlling the operation of this class of apparatus. The paper was accompanied by 26 plates, which are not given in the "American Gaslight Journal," from which the following extracts from the paper have been taken, but which, according to an editorial note, may be had on application to the Secretary of the Association.

The analysis of the various gases from a water-gas set furnishes positive information as to what the machine is doing, and gives a lead as to what is necessary to remedy intelligently any of the inefficiencies in its operation. It is not always possible to secure conditions for the economical operation of a water-gas set, because of inefficient boiler system, blower plant, or other causes; but a systematic analysis of all conditions will yield good results.

It is possible during operation to secure 60 different samples of gas from one complete run and blow. Each sample has a certain value; and the first problem that confronts either the engineer or chemist is to determine which of these samples he needs to secure, with the least possible work, the information he is seeking. The second problem is how to tell, from the samples he has chosen, whether his analysis represents efficiency or inefficiency. It is safe to say that the majority of gas engineers and chemists use the gas analysis as a check on the quality of the gas made, but do not attempt to apply it to locate the cause of trouble if the quality suddenly drops. When the candle power falls, the attempted solution is usually the use of more oil, and at the time it is very probable the machine is then overloaded with oil.

There is for every temperature condition in a water-gas set a certain definite amount of oil that the machine will take care of and convert efficiently into gas. Above this amount, the proportion going into gas drops off rapidly; producing a corresponding increase in the cost of manufacture. This being true, it is waste of time and money to try to correct the inefficiency of the generator or the superheater by deluging the carburettor with oil. What is true of too much oil is also true of too little. When not enough oil is being used to enrich the blue gas and utilize the heat in the carburettor and superheater properly, a large percentage of the oil is decomposed beyond the hydrocarbon point, forming lampblack and hydrogen. One way of checking this condition is to calculate the percentage of blue gas in the finished gas; and this calculation will be taken up later. From the results obtained during several years of operation on five machines, the percentage of blue gas in the finished gas was between 72 and 76 per cent. How very little it changes the make in juggling the oil so that the proportion of oil gas varies 2 per cent. This being true, it must also be true that there is something far more important than a mere difference of a fraction of a gallon of oil from the normal that changes and governs the make and quality of the gas.

Another problem is to determine what causes the various changes in the action of a water-gas set. Some of these are well known, and are often experienced—viz., stoppages due to the formation and deposition of carbon and ash, the formation of a film of insulating substances on the fire-brick, and spray trouble, which usually is easily remedied. An illustration of what could have been a serious form of spray trouble might be of interest. On a carburettor which had been giving good results with the spray nozzle properly adjusted and kept clean, it became necessary to rechequer; and after doing this, black spots developed. On investigation, it was discovered that the brick had been carried two tiers higher than before; and this caused the oil to be distributed unevenly. On the removal of the two extra tiers of brick, the conditions again became normal.

Inability to burn the coke in the generator is a condition often encountered and hard to deal with. One of the objects of this paper will be to apply the analyses of the various gases to show the cause for these conditions, and by the analytical data secure a definite series of formulæ that will answer the investigator in relative figures. A series of curves made by the author furnished analytical data on the composition of every gas that can be secured from a water-gas set under several variable conditions. The samples were secured periodically at different points on the machine, and the data were plotted. Four complete tests were made. Each test covered a week's work; the samples being taken one day, and the rest of the week being spent in watching results. Series of runs and blows were sampled every minute, at the top generator and top superheater, for one hour, which included the usual down runs and generator charging. Three sets of samples were taken—one shortly after the clinkering, half-way between periods of clinkering, and one shortly before the next clinker. The machine was allowed to send directly into a small holder, and minute readings were made during the test run to determine the make. The oil, coke, ash, &c., were carefully kept track of. Temperature readings were made at the centre of the generator, at the centre of the carburettor, and at the top of the superheater each minute between clinkering and each quarter-

minute during test runs. From the data thus obtained the plates accompanying the paper were prepared.

[The author then proceeded to direct attention to the special features of the plates.]

It would be difficult for anyone not familiar with the chemistry of gas manufacture to pick, from the analyses submitted, those which are most necessary for the proper control in the operation of water-gas apparatus; and for every-day use the needed information must be secured with as few operations as possible. It will be found that a daily analysis of the finished gas is very useful in determining the quality of the gas sent out. When trouble occurs, attention should at once be given to the generator condition. Secure a sample of blue gas taken each minute during the run; and in the same manner, secure samples of the blast gases from the generator and superheater. Examine these samples only for carbon dioxide, oxygen, carbon monoxide, in the blue gas for hydrogen, and the work can be accomplished in a short time. The amount of information that can be secured from these few carefully prepared analyses is astonishing. It is evident that, unless the exact way in which the fuel used in the generator is known, we cannot understand why the percentage of carbon dioxide is high or low. The following is a calculation of the distribution of fuel consumption in a carburetted water-gas set, the purpose of which has been shown.

Analysis of Blast Gases by Volume.

	Generator.	Carburettor.	Superheater.
Carbon dioxide	10·2	15·5	19·1
Oxygen	0·8	0·2	0·3
Carbon monoxide	15·0	6·3	0·5
Nitrogen (by difference)	74·0	78·0	80·1

The percentage by weight is arrived at by multiplying each constituent by its specific gravity. The sum of these products gives the weight of the gas, and, when divided by 100, the specific gravity. By dividing the weight of each component part by the weight of the whole, the percentage by weight is secured.

Percentage of Blast Gases by Weight.

	Generator.	Carburettor.	Superheater.
Carbon dioxide	13·7	20·4	24·8
Oxygen	0·8	0·2	0·3
Carbon monoxide	12·7	5·2	0·4
Nitrogen	72·8	74·2	74·5

TABLE I.

—	No. 1. [Test made Oct. 23, 1906.]	No. 2. [Test made Oct. 6, 1506.]	No. 3. [Test made Oct. 26, 1906.]	No. 4. [Test made Oct. 26, 1906.]
Temp. at top of generator	920° C.	997° C.	1101° C.	1193° C.
Temp. at centre of carburettor	669° C.	566° C.	730° C.	680° C.
Temp. at centre of superheater	486° C.	591° C.	480° C.	543° C.
Blast	18·25 in.	17·75 in.	18 in.	18 5 in.
Steam, pounds per square inch	30 lbs.	30 lbs.	30 lbs.	30 lbs.
Oil per minute	10·83 gals.	10·83 gals.	10·83 gals.	10·83 gals.
Oil per 1000 cubic feet	3·90 gals.	3·45 gals.	3·35 gals.	3·30 gals.
Length of run	6 min.	6 min.	6 min.	6 min.
Length of blow	5 min.	5 min.	5 min.	5 min.
Average illuminating power	19·70 candles	21·10 candles	21·40 candles	21·30 candles
Average calorific power	560 B.Th.U.	610 B.Th.U.	620 B.Th.U.	650 B.Th.U.
Make per run	17,000 cub. ft.	18,823 cub. ft.	18,950 cub. ft.	19,910 cub. ft.
Make per minute	2834 cub. ft.	3137 cub. ft.	3160 cub. ft.	3318 cub. ft.
CO_2 in blue gas (by weight)	15·40 per cent.	15·10 per cent.	11·90 per cent.	7 per cent.
CO in blue gas	68·00 per cent.	70·30 per cent.	71·70 per cent.	72 per cent.
Temp. of gen. during blow	890° C. to 980° C.	940° C. to 1021° C.	1065° C. to 1127° C.	980° C. to 1235° C.
Temp. of carb. during blow	631° C. to 825° C.	580° C. to 740° C.	566° C. to 853° C.	593° C. to 805° C.
Temp. of super. during blow	488° C. to 490° C.	582° C. to 590° C.	480° C. to 482° C.	530° C. to 532° C.
Make per day	820,000 cub. ft.	1,022,000 cub. ft.	1,046,000 cub. ft.	1,103,000 cub. ft.
Coke	27,370	25,370	34,985	3160
Oil	3200	3660	4505	3640
Time for clinkering	60 min.	137 min.	84 min.	164 min.

TABLE II.

—	15 lbs. Nozzle Pressure.	30 lbs. Nozzle Pressure.	45 lbs. Nozzle Pressure.
Generator blast	20 in.	17¼ in.	17 in.
Carburettor blast	8½ in.	7 in.	7 in.
Gas made per hour	72,470 cub. ft.	85,070 cub. ft.	82,110 cub. ft.
Gas made per run	13,069 cub. ft.	14,802 cub. ft.	15,341 cub. ft.
Oil used per minute	11·24 gals.	11·19 gals.	11·47 gals.
Oil per 1000 cubic feet	4·62 gals.	3 88 gals.	3·47 gals.
Steam per 1000 cubic feet (estimated)	55 lbs.	68 lbs.	80 lbs.
Average length of blow	5·45 min.	5·31 min.	6·57 min.
Average length of run	5·37 min.	5·13 min.	4·64 min.
Average illuminating power	22·52 candles	22·03 candles	21·37 candles
Average calorific power	630 B.Th.U.	603 B.Th.U.	639 B.Th.U.
CO_2 in blue gas (by weight)	4·0 per cent.	12·4 per cent.	16·3 per cent.
Average temperature of bottom fire	530° C.	330° C.	460° C.
Average undecomposed steam	1·44 grms. cub. ft.	7·02 grms. cub. ft.	15·04 grms. cub. ft.
Number of glass with optical pyrometer—			
(*a*) Carburettor	7	22	17
(*b*) Bottom of superheater	14	16	15
Coke per 1000 cubic feet	41·5 lbs.	37·9 lbs.	42·7 lbs.

Analysis of Blue Gas.

	By Volume.	Sp. Gr. Weight.	Percentage by Weight.
CO_2	3·0 × 1·529	= 4·6 ÷ 54·9	= 8·5
O	0·6 × 1·105	= 0·7 ÷ 54·9	= 1·3
CO	41·7 × 0·970	= 40 5 ÷ 54·9	= 73·6
CH_4	1·9 × 0·570	= 1·1 ÷ 54·9	= 2·0
H	48·6 × 0·0695	= 3·4 ÷ 54·9	= 6·2
N	4·2 × 1·100	= 4·6 ÷ 54·9	= 8·4

Analysis of the Finished Gas.

Illuminants	10·2	CH_4	17·5
CO_2	2·2	H	33·7
O	0·2	N	6·2
CO	30·0		

Since oil gas contains practically no carbon monoxide from the gasifying of the oil, and at most never more than 1 to 2 per cent., the following calculation can be used with reasonable certainty. Percentage of CO in blue gas: percentage in the finished gas :: 100 : x. Therefore the finished gas is 72 per cent. blue gas.

DISTRIBUTION OF COMBUSTION GENERATOR.

Percentage of carbon in CO = 27·27.

As the result of a number of calculations, the author gave the following summary of the distribution of combustion: In generator, 59·2 per cent.; in carburettor, 20·8 per cent.; in superheater, 18·7 per cent.; outside the machine, 1·3 per cent. The distribution of fuel (calculating the carbon in the blue gas) is 33·75 per cent. of the total carbon in the gas.

In Tables I. and II. are given the average of the most important data obtained. It is noticeable that the generator temperature is the only consistent variable; also, as this temperature goes up, the make per run and per hour increase. The oil and coke per 1000 cubic feet are lower, and at the same time the quality of the gas is better. Therefore, up to a reasonable limit, the temperature of the generator is the controlling factor with regard to resulting efficiency.

Some time ago it was necessary to burn coke that made a hot fire and no clinker, but formed large quantities of loose ash. The make per hour, just after cleaning the fire, was good, but soon dropped so low that it did not pay to operate the machine; 75 per cent. of the combustion was taking place in the generator, and only 31 per cent. of the coke was going into the gas. After trying different conditions of blast and steam, the machine was clinkered every ten hours. The result was a 22 per cent. increase in the make per hour for the 24 hours; a 20 per cent. decrease in the coke; a 27 per cent. decrease in the oil; and an increase of 3-candle power and 10 B.Th.U. in the finished gas.

Table II. contains a tabulation of data secured from three different tests on an 11 ft. 6 in. Lowe type of water-gas machine with varying steam pressure. It is valuable, in that it shows that the

amount of steam used in the generator should be subjected to close adjustment. The quality of the gas, as well as the make, suffers when too much or too little steam is used. On one of these steam runs [not tabulated], the excess water was upwards of 200 lbs. per run. This is easily checked by passing the gas through a weighed tube of calcium chloride, using an experimental meter to measure the gas, and weighing the tube at the end of the test. This excess water has a great deal to do with the boiler fuel per 1000 cubic feet.

In conclusion, though the data submitted have been carefully prepared, and in most cases the analytical work has been checked, it is most valuable as a means of comparison by indicating what results different conditions will produce. It must be remembered that every water-gas machine is a working unit, differing in many ways from every other similar machine in operation. In the same manner it may be said that every water-gas operator is a variable that must be studied and analyzed.

UTILIZATION OF SPENT PURIFYING MATERIAL.

Simultaneous Extraction of Sulphur and Cyanides.

In the "JOURNAL" for the 30th of April last (p. 306), some particulars were given of a process for which a patent was taken out for France by MM. Gouthière et Cie., in association with M. Pierre Ducancel, for a process for the simultaneous extraction of sulphur and cyanides from spent gas-purifying materials. An addition to the patent has lately been published, and its nature will be gathered from the following abstract translation of the specification.

In the process forming the object of the principal patent, the spent materials are treated with ammonium sulphide solutions. The residue obtained is then mixed with lime so as to produce ammonia, which is utilized to recover ammonium sulphide, prussiate of lime in solution, and a regenerated purifying material. The addition consists of improvements introduced into the process, with a view to its application to ammoniacal liquor, which usually contains soluble salts of ammonia, sulphur, sulphocyanides and ferrocyanides, and nitrogenous organic matter.

The process consists in first treating the materials, according to the principal patent, with an ammonium sulphide solution. In this way there are obtained, first, a solution of ammonium polysulphide, containing, besides sulphur, ammoniacal salts and soluble sulphocyanides and ferrocyanides; and, secondly, a solid residue containing chiefly prussian blue, nitrogenous organic matter, sulphide of iron, sulphate of lime, &c. The solution and the residue are separated in any suitable way—for example, filtration—and are then treated separately.

The solution of ammonium polysulphide is decomposed by steam, according to the principal patent, and gives regenerated ammonium sulphide (about 80 to 90 per cent. of the initial sulphide), which is again utilized, and also precipitated sulphur, which is separated from the residual liquid by filtration or fusion —the sulphur being then refined by the ordinary methods. With regard to the residual liquid, which contains ammoniacal salts, soluble sulphocyanides, and ferrocyanides, it is decomposed in a distilling column with a barium sulphide or calcium sulphide milk, which reacts on the sulphate of ammonia in the liquid according to the formula—

$$SO_4(NH_4)_2 + BaS = SO_4Ba + (NH_4)_2S.$$

The ammonium sulphide formed is again utilized, and thus replaces the 10 to 20 per cent. fixed during previous treatments. The barium sulphate or calcium sulphate is collected in a filter-press, washed, dried, and reduced with carbon to the state of barium sulphide or calcium sulphide, which is regenerated, and can be utilized for the following operation. Thus the ammonia previously existing in the liquor has been used for the economic regeneration of the ammonium sulphide; the residual barium sulphide being indefinitely recovered. The liquid filtered from the barium sulphate contains soluble sulphocyanides and ferrocyanides, which can be utilized as described later.

The residue resulting from the treatment of the ammoniacal liquor with ammonium sulphide can be dealt with in three different ways. By the first it is diluted with the liquid from the filtration of the barium sulphide, and afterwards treated with boiling milk of lime or some other alkali. Ammonia is liberated, and in conjunction with sulphuric acid forms sulphate of ammonia. The ammonia originates in the ammonium sulphide fixed during the first treatment of the ferrocyanides and sulphocyanides of ammonium existing in the residual liquid, and in a portion of the nitrogenous organic matter.

The materials are then filtered, and a liquid and a residue are obtained. The former contains the prussiates and the calcium sulphocyanides and most of the organic nitrogen. It is evaporated to dryness, the extract is intimately mixed with its own weight of powdered lime, and all is subjected to a kind of dry distillation in the presence of a current of steam. In the circumstances, all the nitrogen held by the residue, in the form of prussiate, sulphocyanide, or organic nitrogen, is transformed into ammonia, which is collected in sulphuric acid to form a fresh quantity of sulphate.

This operation is very easy, considering the small amount of foreign substances in the extract. Gases rich in ammonia are obtained, and consequently are readily absorbed without any special device. Saturation of the acid is thus accomplished with very hot gases, and at the same time there is evaporation of the solution involving precipitation of sulphate of ammonia, which has merely to be collected, freed from moisture, and dried. As, on the other hand, a certain amount of hydrosulphuric acid is produced, originating very probably in the sulphocyanides existing in the extracts, the gas is absorbed by the ammoniacal liquor before treatment with ammonium sulphide. Fixation of the latter will thus be decreased. The residue from this dry distillation, which contains a large quantity of free lime, is utilized mainly in the following operation. With regard to the residue separated from the prussiate of lime liquid, it is oxidized in the air, as stated in the principal patent, and constitutes a regenerated purifying material which can be again utilized in gas-works.

By the second method, instead of treating the residue with milk of lime, it can be mixed with powdered lime, and subjected to a kind of dry distillation in contact with a current of steam. In such circumstances, all the nitrogen existing in the residue, both in the form of prussian blue and organic matter, is transformed into ammonia, which is collected in sulphuric acid to form sulphate of ammonia. This distillation is possible owing to the previous extraction of the sulphur in the ammoniacal liquor. It would not be so if the liquor were utilized without the removal of the sulphur.

The third method consists in drying and oxidizing the residue in a closed vessel, and collecting the liberated ammonia in sulphuric acid. The dry residue obtained at the end of the operation contains all the nitrogen of the prussian blue and of the organic matter. It can be profitably employed as a manure, for which purpose it is very valuable on account of the previous removal of the sulphur and sulphocyanides, which are injurious to plants.

Obtaining Ammonia from Cyanide Compounds.

The specification has lately been published of a patent taken out for France by M. Henri Burgevin for a process for obtaining ammonia from the cyanide compounds in gas-purifying materials. The following are some particulars of the process.

Spent purifying materials contain, as is well known, a considerable proportion of cyanide compounds, from which ammonia can be extracted by dry distillation, by the action of steam under pressure followed by that of the alkalies, or by the action of a mixture of soda and lime. These processes are, however, ill-suited to operations conducted on a manufacturing scale. Either the reaction is only partial, or it involves the employment of soda, which is too costly a reagent for the object in view. The process devised by M. Burgevin obviates these two inconveniences. By proceeding in the manner about to be described, it is possible to transform the nitrogen of the compounds into ammonia by the aid of lime alone—the yield being very near unity.

Whether the compounds have been previously separated by the well-known decyaniding methods, or the raw materials have merely been freed from sulphur by a suitable solvent like sulphide of carbon, the process consists in making slaked lime, in a given proportion and in very intimate mixture, react on the cyanides at red heat. The weight of lime to employ is ten times that of the nitrogen contained in the material to be treated. The mixture must be perfectly homogeneous. The reaction is completed at red heat; and it is carried out in retorts like those used in gas making. Under these conditions, the gaseous mixture liberated contains, in the form of free ammonia, at least 95 per cent. of the nitrogen existing in the materials; and various salts of ammonia can also be produced—particularly sulphate—by passing the gas through sulphuric acid.

When the cyanides are contained in a material in the form of a more or less dry powder (spent purifying materials, desulphurized, and ammoniacal calcic ferrocyanide obtained by precipitation), all that is needed is to make the mixture with slaked lime as intimately as possible. When, on the contrary, the cyanides are in solution, as is the case in decyaniding with milk of lime, the pre-existing ammonia is first separated by distillation, and the residual liquid condensed by evaporation. When condensation is satisfactory, the addition of quicklime, in the proportion already stated, produces in slaking a very close pulverulent mixture ready for treatment. This method also allows of the transformation, at least partial, into ammonia of the small amount of nitrogen compounds other than cyanides existing in the purifying materials.

Reference has been made in previous issues of the "JOURNAL" to the practice of the Education Committee of the Municipal School of Technology in Manchester of publishing, in a collected form, papers read before different technical societies by members of the staff and students. We have just received the fifth of the series of volumes; but the only papers to which our readers' attention need be directed are Dr. Nicholson's, on "Boiler Economics and the Use of High Gas Speeds," read before the Institution of Engineers and Shipbuilders of Scotland, and a comprehensive paper on "Electricity Meters," read by Messrs. Ratcliffe and Moore before the Institution of Electrical Engineers at a recent meeting.

WATER STORAGE AND PURIFICATION.

Three papers dealing with these subjects were submitted to the members of the Institution of Water Engineers at their recent annual meeting at Cheltenham. They were taken consecutively and discussed together.

THE RESERVOIRS OF THE GLOUCESTER WATER-WORKS, AT WITCOMBE.

By R. Read, Assoc.M.Inst.C.E., City Engineer of Gloucester.

In 1855, an Act for the better water supply of the city of Gloucester authorized the purchase of the Robinswood Hill works of the Gloucester Water Company and the construction of the reservoirs at Witcombe. The Corporation purchased the works named for £18,000; and Mr. J. F. Bateman, having recommended the Witcombe scheme as the best one available, the works were proceeded with and opened in 1863. The gathering-ground at Witcombe which he selected is 1500 acres in extent, forming an escarpment of the Cotswold Hills, about five miles eastward of the city. The top of the escarpment is about 950 feet above sea-level, and comprises (in descending order) a small bed of the Great Oolite, Fullers' Earth, Inferior Oolite, Midford Sands, Upper Lias Clay, Marlstone, and Lower Lias Clay.

Unfortunately, the dip of the strata is at an angle of from 7 to 9 degrees away from the face of the escarpment towards the Thames Valley in a south-easterly direction; therefore the amount of spring water (which passes down through the Inferior Oolite, and is thrown out by the Upper Lias Clay on the face of the escarpment at about 600 feet above sea-level), is very limited, varying from 120,000 to 150,000 gallons per day. The escarpment is, however, very steep—in some places near the top being at a slope of 1 in 3; and therefore a large quantity of water (averaging about one-third of the rainfall, and even in the very driest years one-sixth) runs off the surface.

At Robinswood Hill (an outlier of the Cotswolds) the strata are similar but at a lower level; the top being about 650 feet above the sea. They consist of a small capping of Inferior Oolite; and below this, at about 600 feet Ordnance datum, is Upper Lias Clay, then Marlstone, and below this again Lower Lias Clay. The surface of the hill being convex, instead of escarped as it is at Witcombe, the water has to be collected and brought round the contours of the hill in pipes and conduits into the reservoirs; whereas at Witcombe the natural trend of the ground from all points except two small portions on the east and west is towards the reservoirs.

The capacities of the two Robinswood Hill reservoirs are 9 million and 1 million gallons; and of the three at Witcombe, one holds 60 million and the other two 30 million gallons each—making a total of 130 million gallons. The first and second reservoirs at Witcombe were made in 1863; but the second one was enlarged and the third constructed in 1870. All the water is collected in the upper reservoir, and is decanted from it into the other two. The areas of water surface and the depths of water are as follows:—

	A.	R.	P.	Greatest Depth. Feet.
No. 1 reservoir	14	1	9	37
No. 2 ,,	6	3	25	39
No. 3 ,,	7	3	5	19

The works at Witcombe were carried out under Mr. John Hanvey, then City Surveyor of Gloucester, to plans prepared by Mr. Bateman. Owing to the open character of the valley, the embankments were very long. The water face of the lower embankment is sloped at the usual angle of 3 to 1; the outer slopes being 2 to 1 at the top and 3 to 1 at the bottom. The treacherous nature of the Lower Lias Clay was revealed by the fact that the embankment of No. 1 showed signs of slipping directly the reservoir was filled. This may possibly have arisen from not giving sufficient height of bank to allow for settlement due to consolidation. When the lower embankment was constructed in 1870, the same thing happened immediately the old bank which was across No. 2 was cut through; and the greater part of this bank is still in the reservoir—being, of course, submerged. On the advice of Mr. W. B. Clegram, the Engineer to the Gloucester and Severn Canal Company, about 2000 tons of Birdlip stone was placed on the outer slope of the embankment; and this stopped the sliding movement. The overflow or bye-wash is carried round the outside of No. 2 reservoir, and is built in brickwork; the bricks having been made from the clay found on the ground. Part of the water from the stream was, however, sent down to Gloucester as soon as the 12-inch main was laid, without waiting for the reservoirs to be completed.

In 1874-5, the city was extended by the whole of the Barton district being taken in, thus increasing the population by about 15,000, and making a total of about 32,000; and on the author's appointment in March, 1878, he had to face the prospect of an early deficiency in the water supply. The meters on the 12-inch main at Hucclecote, being out of order, were first repaired, after which a house-to-house inspection throughout the city was organized, and was carried out during the following year. This inspection revealed the fact that although about 1600 houses in the added district had not had the water laid on, a great number of those which had it had no flushing-cisterns to the closets; and the consumption worked out at something like 32 gallons per head per day. In the following year (1880), as it was impossible to give a constant supply, a Deacon meter was installed; but as this was worked by a pendulum clock, the results were not very satisfactory. The makers, however, substituted for it a watch movement, and very much improved the meter generally, so that in 1883 the author adopted the system throughout the city, which was mapped out into twenty districts. The installation was completed in October, 1883, at a cost of £2000; and by June, 1884, the consumption had been reduced to 16 gallons per head per day. It now averages about 20 gallons.

In 1880, Mr. J. F. Bateman was called in to report upon the best means of obtaining an additional water supply, and he recommended tunnelling in the Upper Lias Clay above the Witcombe reservoirs for a length of about half-a-mile, with the view of tapping the Midford Sands below the Inferior Oolite, and so intercepting the water flowing down the dip of the strata towards the Thames Valley. The yield of water which would be obtained being unknown, and depending upon the sand beds being of considerable thickness, trial borings were put down. Though some water was found in them, it was doubtful whether a sufficient quantity could have been obtained from this source; and as the result could not have been proved until the tunnel had been completed, and as, moreover, the Local Goveanment Board ruled that the scheme was beyond the scope of a Provisional Order and would necessitate an Act of Parliament, it was abandoned.

Happily, the reduction of waste resulting from the system of night inspection was so great that the supply was maintained without additional works until 1890. At Christmas time of that year, however, a very severe frost set in, during which the Witcombe reservoirs were covered with ice 12 inches thick; and the supply had to be supplemented by water from the Severn at Walham and from the canal. Early in 1891, Mr. William Fox was called in to advise, and he investigated nine different schemes for an additional water supply, including the Newent pumping scheme, which was finally decided upon and has since been carried out.

Previously to 1901, great trouble was experienced during the summer months from weeds growing in the Witcombe reservoirs, which imparted a fishy taste and smell to the water. These were the *Chara vulgaris* and the *Nitella*, which grow rapidly in waters collected from the limestone formations, where the light can penetrate the water to a depth of 15 feet, especially when the temperature of the air is above 55°. On the recommendation of the author, supported by Mr. Embrey (the City Analyst) and Dr. Campbell (the Medical Officer of Health), ten mechanical filters, made by Messrs. Bell Bros., of Manchester, were installed in 1901 to deal with this difficulty. Each filter consists of a wrought-iron cylinder, 8 feet in diameter and 8 feet high, filled with about 7 tons of fine silver sand from Leighton Buzzard, and is capable of filtering at the rate of 150,000 gallons in 24 hours. The capacity of the ten filters is therefore 1½ million gallons per day—thus giving an ample margin over the average rate of filtration, which does not exceed 750,000 gallons in 24 hours. The bottom of each cylinder consists of 144 cones filled with coarser sand and gravel; each cone being 6 inches diameter with a large number of ⅛-inch holes drilled in the surface, by which the filtered water is discharged over the whole area of the filter, and the fine sand is prevented from being washed down into the outlet-pipes. The filters are cleaned by reversing the direction of the current for about 15 or 20 minutes, during which revolving arms stir up the sand so that the whole is thoroughly washed; indeed, it was this system of washing the sand which decided the author to select the Bell filter, as no other at that time was provided with it. In order to arrest completely the suspended matter, about one-third of a grain of sulphate of alumina per gallon of water is used. The filters have acted admirably since their installation, and have always removed all taste and smell from the water, though at times they have been severely taxed.

In the year 1905, the author obtained from the Massachusetts Bureau of Agriculture some very favourable reports on the use of sulphate of copper; and, after consulting the City Analyst, he decided on making an experiment with this, with a view to reduce the work of the filters when the growth of weeds in the reservoirs was exceptionally prolific. About the same time, the late Mr. Haynes, of Newport (Mon.), made a trial of this in his reservoirs, but found that, probably owing to using too strong a solution (1 in 500,000), he had killed some of the fish. The American experiments had been made with proportions varying from 1 in 500,000 to 1 in 1,000,000; and as the author wanted to be on the safe side, he used a proportion of 1 in 3,000,000. The sulphate of copper, in the form of powder, was put up in 7 lb. bags, and thrown out with a trowel from a punt which was propelled up and down the reservoir in regular lines. In doing this, it is important to avoid the powder being blown into the eyes by the wind. The City Analyst is of opinion that the smell and taste do not arise from the weed itself, but from small seed pods on the back of the weed, containing a kind of essential oil, which, on the bursting of the pods, imparts the taste and smell to the water. The result of the treatment with sulphate of copper was that in a few hours the surface of the water was covered with bubbles of gas caused by the action of the sulphate on the seed pods. In two days the water became much clearer than it had previously been; and in about a week after treatment it was fit for use, without any trace of copper.

The reservoirs have been treated three times since 1905; the best time of year being in the spring, before the weeds begin their

rapid growth. On the second and third occasions, the sulphate was used in the proportion of 1 in 1,000,000; but on neither were any fish killed by the sulphate. However, on the last occasion, in one reservoir, where large numbers of roach were usually found, many of these were practically starved for want of food, owing to the destruction of the weeds, and it was necessary to empty the reservoir in order to get them out. Fortunately this occurred at the end of the drought of last summer. On the first occasion, it was found that the weeds grew rather more quickly the following year; but whether this was due to the treatment or to other circumstances is uncertain. Undoubtedly the treatment is beneficial to the water, and relieves the filters very considerably. Moreover, as the weeds grow on the bottom, it is most difficult to get them out by any mechanical means without emptying the reservoirs.

COPPER SULPHATE FOR PURIFYING WATER SUPPLIES.

Mr. George Embrey, F.I.C., the County Analyst of Gloucestershire, read a paper on this subject. In the course of it he said that in the year 1870, he had frequent opportunities for observing the evil effects of plant growth in the artificial lakes of Sutton Coldfield. Attempts were made to destroy the weeds by fixing scythes to the bottom of a punt, and dragging this through the water, afterwards removing the weeds by means of rakes. This method was most costly, and not very effective; but in 1872, in the construction of a railway between Sutton Coldfield and Walsall, an embankment which passed over the end of one of the lakes was constructed with ferruginous sand, and this washing into the lake effected in one season what the cutting method had failed to accomplish in seven. The vegetation was entirely destroyed, and this particular pool was effectually cleared of weeds.

On removing to Gloucester in 1873, the author observed the bad odour and colour of the drinking water; and on inquiry he was told that this was due to plants growing in the reservoir. He at once suggested to the City Surveyor (Mr. R. Read) the use of ferrous sulphate; and an experiment was made on one of the reservoirs. About this time some trouble arose at a tannery, due to oxide of iron from rusty pipes staining the skins red. This being wrongly attributed to the iron used in the reservoir, the experiment was discontinued, and for many years the weeds were removed by rakes at considerable expense without any satisfactory result. The establishment of the Bell filters in 1901 to a great extent overcame the difficulty; but the author's attention was at that time directed to the reports of experiments made by the United States Department of Agriculture with copper sulphate, which seemed to be an effective remedy. In the course of that year, some watercress beds were treated with copper sulphate, which was found to destroy the algæ, without injuring the cress. In 1904 and 1905, numerous investigations were made to determine the amount which could be used for the destruction of the lower forms of plant life without destroying the fish or rendering the water toxic to human beings. It was found that quantities of 1 in 1,000,000 fulfilled these conditions; but quantities of 1 in 3,000,000 were sufficient to destroy the algæ, which were believed to cause the trouble. In 1908, permission was given by the Sanitary Committee to carry out an experiment at the Witcombe reservoirs which were at the time choked with *Chara vulgaris*. The water, had a distinct colour and a fishy odour.

The author's method of applying the copper sulphate differs from that usually adopted, which is to place the crystals in a canvas bag and trail this at the stern of a moving boat. The defect of this method is that the solution is very much diluted before reaching the bottom of the reservoir. This, however, is overcome by scattering the fine crystals over the surface of the water, as in sowing seed; the crystals falling rapidly to the bottom before dissolving. The sulphate is used in the form of a fine powder containing 98 per cent. of the salt; the present price of this being 28s. per cwt.

For the three reservoirs, which have capacities, when filled, of 60, 30, and 30 million gallons respectively, 4 cwt. of sulphate is used—approximately a proportion of 1 in 3,000,000. Each reservoir is allowed to stand at least three days, and, if convenient, a week, at the end of which period not a trace of sulphate of copper can be found in the water.

The water should be treated in the early spring (about February), when the bottom is usually covered with diatoms only; in March and April the confervæ make their appearance, and later the *Chara* begins to grow. It has been found that if the treatment is applied in the early stages, the diatoms are destroyed, and neither the confervæ nor the *Chara* appear.

The Gloucester reservoirs are stocked with trout; and it has been important not to destroy these. In the author's opinion, the roach disappeared, not by their having been poisoned, but owing to the removal of the vegetable food on which they live. This view is supported by the result of an experiment made at the end of last summer, when, the third reservoir being nearly empty, the rest of the water was, with the sanction of the City Surveyor, drawn off, and, the trout having been removed to No. 2 reservoir, only a few starved roach were found remaining.

As regards the question, What becomes of the copper sulphate? It has been suggested that it unites with carbonic acid, and becomes carbonate; but the author has been unable to find this salt. He has, however, noticed that the stones with which the reservoirs are partly lined become coated with the two oxides of copper; bands of red cuprous oxide being traced, which, after exposure, become black by oxidation to cupric oxide.

After four years' experience, the author can confidently say that the odour and colour so frequently met with in reservoirs containing water collected from the Upper Lias and Inferior Oolite can be perfectly removed by the use of sulphate of copper, and that no danger need be feared if the operation is performed with care and under proper supervision.

SELF-POLLUTION OF WATER BY NATURAL GROWTHS.

Dr. J. H. Garrett, the Medical Officer of Health of Cheltenham, read a paper on this subject. He pointed out that the organic polluting material found in all water is derived from living organisms immediately or more remotely, and water often becomes polluted by the decaying bodies or products of the fauna and flora to which it supplies the natural medium of existence. So long as water is hidden in the deep strata of the earth, out of reach of the air, it remains of the same composition; but when brought to the surface and left for some time exposed to the air in reservoirs or receptacles, it becomes the *habitat* of organic growths, which in the course of time prove themselves capable of altering its chemical composition, sometimes resulting in such considerable pollution as to render quite unfit for drinking a water which was in the first instance a spring water of excellent potable quality.

Apart from organisms of bacterial species of very minute size, and certain other large organisms, the admission of light to the water of which the surface is exposed to the air is essential to the development of the living organic bodies that are destined to become water polluters. This is the case with all green growths—light being essential for the development of the chlorophyll; and many plants, being dependent on this for their existence, cannot grow except with the assistance of daylight. This is an important point to remember when it is required to keep water free from such growths, and from the effect they produce upon the quality of the water—a dark reservoir proving a sufficient preventive to the undesired phenomenon.

It appears that the water derived from certain rocks exhibits a preferential tendency to develop particular polluting organisms. The water that has filtered through the limestone of the Inferior Oolite of the Cotswold Hills, for example, is particularly prone to develop the troublesome water plant *Chara*, which affects all water derived direct from springs situated at the base of these rocks when such water is stored for any considerable time in reservoirs. It is possible that small quantities of phosphate and nitrate contained in the water derived from this source may stimulate the growth of this plant, which also seems to require the presence of carbonate of lime, for it exhibits a peculiar power of forming accretions of calcium carbonate in and about its cells.

During the summer months, *Chara* vegetates apace, reaching a height of more than a foot, where it grows in large patches upon the sides and bottom of the reservoir, which serves it best when offering a rough surface such as that of common brickwork or loosely laid stones, and serves it ill when consisting of smooth cement or concrete, into which it is impossible for roots to penetrate. In fact, the covering of the brickwork with a smooth layer of cement has proved a preventive of the growth, a least for a considerable time. Towards the end of summer, the plant begins to die down—its green growth losing in substance, and becoming duller in colour. In connection with its decay, numerous minute organisms appear and swarm the water, entirely spoiling it for drinking purposes by imparting to it a disagreeable odour and taste. A chemical effect of the growth of *Chara* and its accompaniments in the Cheltenham reservoirs is to add considerably to the organic content dissolved in the water, and to reduce to nitrite the small quantity of nitrate naturally contained in the water. This is learned on comparing the results of analyses of the water as it enters the reservoir from the springs with those of the water from the bulk contained in store.

Water containing a trace of iron is liable to be affected by the microscopic filamentous alga called *Crenothrix*, which contains no chlorophyll, and is capable of growing in the dark, as within water-mains, for example; and the thick coating at times found deposited upon the inner surface of water-pipes may consist of this organism together with carbonate of lime and iron rust. But *Crenothrix* sometimes swarms through the water of a reservoir, giving it a red-brown colour for a time. The water supplies of several Continental towns have been visited in this way; but the author said he believed the only recorded instance in England was that of Cheltenham, where, in the early spring of 1896, the Dowdeswell reservoir, receiving the head water of the small River Chelt, was affected in a very marked manner. There are some oozings of iron-stained water at several places in the banks of the reservoir, and in the year named it was never filled to overflowing, as it generally is; and the water was consequently less well aërated and more concentrated in local constituents than usual. The organism swarmed through the water, rendering it red in appearance. Filtration removed the greater part, and the dirty sand of the filters had a very unpleasant odour; and from this sand the organism was obtained in concentrated numbers. The water-pipes were infected by members of the *Crenothrix* that escaped the filters; and the organism underwent further development and multiplication in the pipes. The experience afforded a charming microscopic and chemical study. The water yielded a bad analysis during the period it was affected, and many complaints in regard to it were received; but no harm to health

appeared to follow its consumption. The visitation lasted for about six weeks, when it cured itself spontaneously and completely in a manner remarkably analogous to a zymotic malady in the animal body, in which for a time a microbe swarms, reaches its acme of development, and then dies out.

The author concluded by saying that one interesting point in connection with the growth of *Chara* in some of the Cheltenham reservoirs was the fact that the numerous organisms that feed and depend upon this weed make excellent food for trout. The fish put into the Hewletts reservoirs which contain the plant develop with quite amazing rapidity, quickly outgrowing fish of the same size and sort placed at the same time in the larger reservoir where there is no *Chara*. He thought this fact might be of interest to pisciculturists, or at least to those who are using the Cotswold Hills water, or a water similarly charged with carbonate of lime, in the rearing of trout.

Discussion.

Mr. W. Watts (Wilmslow), in a written communication, said before animal and vegetable growths could exist in water there must be food for them to live on; and attention should be given to the sources whence the supplies came. Plants and animals fed on substances in solution and in suspension in water; and if these substances could be kept out of it, the chances of such life surviving were destroyed. Streams supplying water in a flooded condition should be diverted and not allowed to mix with potable supplies; and all water for domestic use should be aërated and atmospherically bleached by exposure as much as possible. The water from natural springs flowing sufficiently high should be collected and piped direct into a covered receptacle feeding the supply-main; and it should not see the light of day until it was drawn from the tap of the consumer. Water that was retained in darkness for some time appeared to have a great affinity for collecting atmospheric and other impurities more readily than that coming from a suitable drainage area. Shallow depths in reservoirs should not be allowed more than could be helped. They were favourable cultivating places for *Chara* and other forms of aquatic plant life, and the breeding and nursing ground for many low forms of animal life. It was a wise plan to lower the water in reservoirs from time to time when the weed was thriving, so as to kill it, or at least to check its growth. Plants and vegetable growths of the kind alluded to in the papers did not grow in deep water; therefore it was better, if possible, to excavate the ground in the shallow edges of reservoirs, using in the embankment the material taken out. The working capacity of most reservoirs was confined, in the main, to the upper half in the depth of it; and it was in this zone that the removal of the excavations should be effected. The area submerged by the rise and fall of the water, as it was decanted for use, should be stone-pitched, not only to protect the slopes from the wash of the wavelets, but to prevent the growth of plant life. The slopes were naturally sweetened by occasional exposure to the air, and the life forms complained of destroyed. Weed of all kinds should be removed as soon as it appeared. Moorland water flowing from the Pennine Hills, treated in this way, required little or no filtration, especially if the flood water were carefully separated from the normal flow of the streams feeding the reservoir. Peaty discoloration, however, was complained of, but was harmless; and the stain was largely removed by exposure in the reservoirs. By frequently lowering the water in a reservoir, it was possible to destroy the small univalve shells and aqueous plants growing in it. It was unwise to keep the water at a common level too long, especially in the summer months. Money spent in making the water pure at the source was preferable to chemically treating it in any way.

Mr. Burgess said Dr. Garrett would be doing all the members a kindness by supplying an analysis of the water in its normal state and as it was when suffering from the complaint of *Chara*. The difficulties in connection with the storing of spring water were now well known. The reservoirs made for containing it were often of such construction that it was difficult to cover them economically. His experience went to show that the only thing in favour of storage was that it decreased the hardness of the water. In one case of which he knew, the degree of hardness had fallen from 19 to 11; and this was all they had to set off against the trouble due to the growth of vegetation and the increase of fish. The common variety of *Chara* had the power of attracting to itself carbonate of lime, and it was found that a single hundredweight contained 23 lbs. of carbonate. With regard to the treatment of water by sulphate of copper, in the first place it was used by American farmers for dealing with blight; and its employment for this purpose no doubt suggested the idea of trying it for the other. He reminded members that in 1907 the Metropolitan Water Board had trouble with their reservoirs. The details of the treatment applied would be found in the official reports of the water examiners for August in that year.

Mr. Blackburn said that at Sunderland they had a growth of weed in the stonework on the floor of the reservoir. He had the bottom relaid with a smooth surface, and this stopped it altogether. They also found that the floor of a reservoir which was open to the atmosphere became covered with a carpet-like growth of a diatomaceous character, and after hot, sunny weather it all rose to the surface. In the inlet-basin of another reservoir they had a growth which was identified as being a species found only in stagnant water.

Mr. Luke Hill, late of Georgetown, British Guiana, said when he was in that colony the inhabitants obtained their water from tanks in which the rain water was collected from the roofs. In a climate like that, there was very little pollution from smoke, but there was a certain amount of washings from the roof which might be a cause of pollution. They had, however, a purifying agent in the shape of the larva of the mosquito. But of late years, in the carrying out of the scheme for protecting the inhabitants against malaria and yellow fever, they had been advised to destroy the larvæ. In doing this they got rid of their purifying agent, and the water became a source of danger in regard to typhoid and other diseases of this class. At Georgetown, in addition to the water from the cisterns, they had another source of supply in open canals, the water from which was of a rather fœtid nature, and was not used for drinking purposes. In these canals they were much troubled with growths such as were met with in this country.

Mr. Read, replying upon the discussion, said, with reference to what had fallen from Mr. Burgess as to the large amount of lime taken up by the *Chara*, that its home was practically in limestone water. Commenting on Mr. Blackburn's remarks, he said he could bear out what that gentleman said as to *Chara* not growing on a cemented floor. He had cemented the bottom of one of the Gloucester reservoirs, and since then they had had no growths of any kind there. With regard to Mr. Hill's observations, he thought rain water was much neglected in England. In very few modern houses were rain-water tanks put up, though they were a most useful adjunct to the ordinary supply for washing clothes, &c.

Dr. Garrett also replied. He said the removal of carbonate of lime by the *Chara* in the Cheltenham reservoirs reduced the hardness by 2°. These organisms certainly polluted the water to a considerable extent. Mr. Blackburn's experience was interesting to them at Cheltenham, because they had discussed the possible cementing of the floor of the reservoir to prevent the growth. What he had stated would encourage them to do it, though he thought that to cement over their large area would cost a considerable sum. With regard to the ordinary green water-weeds, one did not look upon them as causes of serious pollution; but at the end of the year they fell into decay, and so might have a polluting effect. Referring to what Mr. Hill had said, more use might, no doubt, be made of the rainfall in this country; but, as a Medical Officer of Health, he could only speak against the ordinary water-butts in back yards, the water in which became extremely foul.

HYGIENIC EFFECTS OF THE USE OF GAS.

At the last annual meeting of the Southern Gas Association, held at Jacksonville (Fla.), a Committee, consisting of Messrs. T. D. Miller, James Ferrier, and J. N. Cooke, appointed to consider the subject "Ventilation," submitted the following report, which it was decided should be incorporated in the "Proceedings" of the Association.

The subject presented is so extensive and important that the utmost your Committee can attempt is to review the result of recent investigations, and present the conclusions that appear to be justified by these investigations.

This Twentieth Century will probably be known as the "Sanitary Age;" or, in other words, the age in which the prevention rather than the cure of disease became the chief aim of the medical world. A living atmosphere as near as possible to "open air" conditions is one of the great *desiderata* in sanitation. The important requisites of such an atmosphere appear to be: (1) A certain proportion of oxygen fresh from contact with vegetation; (2) limited proportion of carbonic acid; (3) absence of organic matter, whether in the form of active germs or simple cells.

The first of these requisites—that oxygen "revitalized" by recent contact with vegetation is essential—seems to have been established by the experiments of Dr. Richardson twenty-five years ago. The permissible limit of carbonic acid has been considerably modified as the result of recent investigations; it having been established by experiment that as great a proportion as 0·5 per cent. does not cause reduced vitality. Even as rigid an authority as Dr. Haldane is quoted as saying that 20 parts in 10,000 may be breathed without physiological detriment. As to the third requisite, there seems to be no exception to the rule demanding the total absence, or, if not, the torpidity, of organic matter as an essential of a hygienic atmosphere.

Argument is unnecessary to demonstrate that the conditions above described cannot be attained, much less maintained, in buildings as at present generally constructed, whether for residence, business, or educational purposes. A room cannot be inhabited without promoting conditions adverse to the three requisites given above. Conditions may be modified by the use of doors, windows, and ordinary flues, but only in a partial and unsatisfactory degree.

It may, therefore, be asserted, without fear of contradiction, that a constant renewal of the atmosphere of a room is absolutely necessary for the maintenance of that atmosphere in a hygienic condition. This plainly signifies that means must be provided to secure an unintermittent expulsion of the vitiated atmosphere, with a concomitant influx of fresh air to take its place, to render a room fit for healthful habitation.

It is now time to inquire how the use of gas, whether for lighting or heating, affects hygiene under present conditions, and what would be its effect under improved conditions. Let us suppose two inhabited rooms, without special means of ventilation, one lighted by electricity and the other by gas. In the first there will be three reversals of hygienic conditions—viz., a diminished proportion of oxygen, a larger proportion of carbonic acid, and an increase of organic matter. In the second (lighted by gas), there will be two reversals slightly, but only slightly, aggravated—viz., a diminished quantity of oxygen and an increased quantity of carbonic acid—but, so far as organic matter is concerned, a distinct improvement caused by the sterilizing effect of the gas lights. We have supposed these conditions; but they have been verified by actual experiment. One of us [Mr. Ferrier] in 1901 found that the diminution of oxygen never amounted to 1 per cent., even under the abnormal condition of a room closed quite tightly for five hours with gas lights and a flueless gas-heater both in use. The carbonic acid never exceeded 32, and was sometimes as low as 13, parts in 10,000. Recent experiments have shown that in inhabited rooms lighted by electricity as compared with those lighted by gas, the difference in the proportion of carbonic acid was practically negligible; while in the latter case, the organic matter very soon became *nil*, as against a serious increase in the former.

It may be only a coincidence, but it is a fact that the growing demand and need for perfect sanitation and ventilation and the increase in percentage of infectious diseases are co-extensive with the introduction and development of electric lights and the electric fan. The latter has an agreeable effect in removing a heated envelope of air from the body; but its effect in bringing dust and germs into the breathing zone renders its use questionable in a hygienic sense. Experiment seems to establish the fact that in closed rooms the vitiation, so far as oxygen and carbonic acid are concerned, ceases to increase when the temperature becomes stationary. The probable explanation is that the generation and loss of heat are accompanied by a circulation of the air, resulting in sufficient ventilation even when doors and windows are closed. It is to be feared that most medical men who have recorded their preference for electric lights on hygienic grounds have founded this preference more on theory than on fact ascertained by experiment.

Passing to conditions which would obtain were buildings constructed, as they should be, with special means of ventilation, it is here that the use of gas becomes a potent agent in securing healthful atmospheric conditions. The burning of gas produces a column of hot air which rises towards the ceiling—thereby creating a circulation of the air; so that gas lights have not only the effect of sterilizing, but of renewing, the atmosphere when suitable openings for efflux and influx are provided. Gas lights provided with tubes for carrying off the products of combustion have been used with marked success for ventilating purposes. The unused energy represented by the heat of the gas light can thus be made highly beneficial; and no doubt it will be extensively utilized in this manner, especially if gas men will set the pace, and put their energies behind the movement. It may be put down as an axiom that, whatever may be the ebb and flow in the course of competition, the business will ultimately go to those who supply the most energy for a given sum. It is therefore true business policy to see that all energy is beneficially applied.

We have not touched upon the effect of moisture resulting from the combustion of gas. The moisture produced by burning 1 cubic foot of gas would measure about 1·25 cubic feet were it to remain in a gaseous condition, which it never does—being condensed by contact with the walls and other surfaces. Considering the great amount of light now produced from a small volume of gas, a simple calculation will show that the quantity of moisture added to the atmosphere of a room is almost negligible, apart from the fact that a slight addition of moisture is, under certain conditions, a positive benefit.

Conclusions.

1.—No interior atmosphere can be considered hygienic unless means are provided for a continuous influx of air (preferably filtered and washed), together with an accompanying expulsion of vitiated air.

2.—Few buildings to-day are provided with such facilities for ventilation. Doors, windows, and ordinary flues are but haphazard means to that end; ventilation being only an incident in their utilization.

3.—Even when buildings are not specifically equipped to take care of ventilation, gas lights are more beneficial than otherwise.

4.—Where rooms are equipped with ventilating openings, the use of gas lights is highly beneficial; and flueless gas-heaters, of proper design, are permissible, if not positively beneficial.

5.—That the efforts of the gas industry generally should be directed towards securing proper construction, whereby the surplus energy of gas would become a necessary assistant in securing hygienic conditions; thereby promoting the welfare of the business, and at the same time not only meeting but routing the critics on their own ground.

In connection with the foregoing report, it will be of interest to reproduce, from a recent number of the "Gas Institute News of the American Gas Institute," the following account given by Mr. Charles O. Bond of some ventilation tests with gas carried out in the photometrical laboratory of the United Gas Improvement Company.

The first set of tests was made using a wooden flue, 11·6 feet in length, which had been so constructed as to permit its cross sectional area to be varied from 0·43 square foot to 1·73 square feet. This flue was rectangular in cross section. Its upper end projected 2 feet above the floor of the second storey, and its lower end hung into the room below. The lower room had a content of about 5200 cubic feet; the upper room had a content of about 1700 cubic feet. All possible outlets through the ceiling between the two rooms, other than the test-flue, were closed; and an open circuit was established through the remainder of the building, to balance the pressure and to keep the circulation uniform. Four thermometers were used for temperature measurements; velocity measurements were secured by means of a 3-inch Byram anemometer; and the relative humidity of the air was determined by an Assman psychrometer. The lamp used in the test was a No. 905 four-burner upright Welsbach, having no obstruction or baffle above its normal outlet; so that the products of combustion discharged direct vertically into the bottom of the flue. Arrangements were made so that the top of the lamp-stack could be varied from 0 inch distance to 18 inches below the bottom of the flue. The gas used was a 640 B.Th.U. gas, and its rate of flow was measured through a test-meter.

In each case it was found advantageous to withdraw the lamp-stack vertically from the inlet to the flue for distances varying from 9 to 18 inches. The theoretical discharge from these flues varied from 12,000 cubic feet per hour through a 0·43 square foot flue to 35,000 cubic feet per hour through a 1·73 square feet flue; and the actual discharge was found to vary, on an average, from 9200 to 28,000 cubic feet per hour, or, in all cases, the average efficiency of the flue was between 75 and 80 per cent. (all volumes of air corrected to 60° Fahr. temperature and 30 inches mercury). The smallest flue showed a temperature difference between its top and the incoming air at the bottom of 53° Fahr., and the largest flue a difference of 20° Fahr. The area of the metal lamp-stack was approximately 0·2 square foot. The consumption of the lamp was about 19 cubic feet per hour; so that of the volume of gases removed from the room, as shown above, certainly not more than 200 cubic feet per hour were products of combustion. It can be seen from this that, roughly speaking, the air in the room was completely changed from two to five times per hour through the action of the gas-lamp.

The test as thus far conducted, however, is not in accordance with the conditions which would be met with in practice. As a rule, room outlets are either on the vertical walls near the ceiling or else through the ceiling itself, and do not, as in the case cited, extend down into the room; and for this reason it would seem that the ventilating effect of the lamp in a room ought to be better the higher the flue opening.

In the second part of the test, the bottom of the flue was flush with the ceiling, which was a thick one; and the initial section of the flue was in all cases 15 inches square, and made a 15-inch vertical rise in order to reach the floor above. The effect of the air discharge from the room was then studied—(1) when the lamp was hung at varying horizontal distances from the flue opening, (2) when a vertical flue was extended above the initial section, (3) when a horizontal and then a vertical flue were extended above the initial section, and (4) when first a vertical and then a horizontal flue were extended above the initial section. Under these varying conditions, where vertical flues alone were used, and the lamp outlet was placed 24 inches directly below the centre of the flue opening, a considerable increase in efficiency over the figures above mentioned was obtained.

Seventeen different combinations of vertical and horizontal runs, with 90° bends, were tried; the most unfavourable being that in which, out of a total length of 16·5 feet, only 3 feet was vertical rise, and in which the lamp was distant 5·3 feet from the inlet to the flue. In this position, the discharge of air through the flue amounted to 7650 cubic feet per hour.

The greatest removal of air occurred where the flue was a vertical maximum at 6·25 feet with the lamp directly below it, when 27,700 cubic feet of air were removed; and when the lamp was placed 5·3 feet away from the bottom of the flue, there were still removed 13,140 cubic feet.

The extreme case was that in which 23·4 feet of flue was used, 8 feet being vertical, and 13,700 cubic feet of air removed. All these figures, from the best to the poorest, when compared with a theoretical discharge, showed an efficiency varying from 44 to 100 per cent.

The formula on which the theoretical discharge was based is

$$V = 8{\cdot}02 \sqrt{\frac{H\,(T - T_0)}{T_0}}$$

where V = velocity in feet per second,
H = height of chimney in feet,
T = temperature in flue, deg. Fahr. absolute, and
T_0 = temperature of surrounding air, deg. Fahr.

In ventilation problems, whether the source of vitiation is combustion or respiration, the economical thing to do, if possible, is to withdraw these vitiated products before they are generally disseminated through the room, rather than simply to pass an enormous volume of fresh air through the room. It can be seen that, even though the ventilating flue may offer a tortuous passage for the escape of waste and heated products, if the lamp is venting its hot products in the vicinity of the flue, it is above demonstrated that all these products will be withdrawn, besides the ventilation effect secured by the removal of additional air.

NATURAL GAS SPRINGS IN ITALY.

The July number of the "Rendiconti della Società Chimica Italiana" contains an article descriptive of two springs of natural gas which have been discovered at Pisa. The following abstract translation furnishes some particulars in regard to the characteristics of the gas.

In some borings for water made in the quaternary formation which constitutes the plain of Pisa two springs of natural gas were met with which are deserving of attention by the chemist and the geologist. The first was discovered in 1904 at a point about 1¾ miles east of Pisa, in the territory of Ghezzano, where, when the drill had reached a depth of 81 feet, a strong jet of gas issued from the borehole. When ignited, the flames reached a height of 33 feet, endangering the safety of a neighbouring villa. This gas, which is now conveyed through mains like ordinary coal gas, is used for lighting and heating purposes at the villa and the adjoining farmhouse. The second spring was discovered early in the present year, about the same distance from Pisa, near the Medici aqueduct, at a depth of 60 feet from the surface of the ground. Here also the gas issued with great force at a pressure of about 2 atmospheres.

The odour of the gas is like that of coal gas, only less powerful. When passed through a small orifice, and ignited so as to give a jet about 0·2 inch high, the flame is of a pale violet colour, and not at all luminous. On the pressure being increased, and the jet lengthened to 0·8 inch or more, the flame is colourless in the centre, violet on the lower part of the edge, and only slightly luminous on the epex. The author analyzed the gas by means of the Hempel process, measuring off 100 c.c. and making the usual absorbing liquids—caustic potash, bromine water, potassium pyrogallate, and cuprous ammoniacal chloride—act one after the other on the gas. The results, which are the averages of three analyses, were as follows:—

	Per Cent.
Carbon dioxide	3·89
Heavy hydrocarbons	0·93
Oxygen	1·18
Carbon monoxide	0·49

Thus these constituents represent 6·49 per cent. of the volume of the gaseous mixture examined. The gases remaining after absorption of those mentioned may be hydrogen, methane, ethane, among the other paraffins, and nitrogen. These other constituents thus represent a total of 93·51 per cent.

With regard to the qualitative composition of the gaseous residue, the fact that after the explosion it was absorbed to a great extent by potassium demonstrated the presence of hydrocarbons. The author thought it might therefore be admitted that the residue was composed of methane or ethane, alone or mixed, and associated or not with free hydrogen. After carefully examining the various systems of equations giving the volumes of the constituents according to the different hypotheses, he found that the equations giving figures in perfect agreement with experimental results were only those which comprise the presence of methane and ethane. Consequently, he thought the gas exploded should be regarded as a mixture of methane and ethane accompanied by nitrogen; and he found it to be of the following composition: Methane, 20·36 c.c.; ethane, 1·53 c.c.; nitrogen, 1·70 c.c.—total, 23·59 c.c., the quantity of the gas submitted to experiment being 23·60 c.c. To calculate their percentage, these results must be compared with the percentage of the total volume (93·51). Thus, after making the requisite calculations, we have the following: Methane, 80·71 c.c.; ethane, 6·06 c.c.; nitrogen, 6·73 c.c. The composition of 100 volumes of the gas is therefore as follows:—

	Per Cent.
Carbon dioxide	3·9
Heavy hydrocarbons	0·9
Oxygen	2·1
Carbon monoxide	0·5
Methane	80·7
Ethane	6·0
Nitrogen	6·8

This natural gas is therefore very like coal gas, from which it differs, however, in the absence of free hydrogen and the small quantity of hydrocarbons rich in carbon. This explains the non-luminous flame. It is quite suitable for heating, like coal gas; and with a mantle it is excellent for lighting. It now only remains to measure the pressure from time to time, to see whether or not it continues constant. If, after examinations made at sufficiently long intervals, there is no fall in pressure, this gas would, in the author's opinion, prove an inestimable source of power.

Distinction for the Makers of the Graetzin Burner.—The firm of Ehrich and Graetz, of Berlin, who have been foremost in the introduction and development of the inverted gas-burner in Germany, have just had conferred upon them the rare distinction of the "Gold Government Medal," inscribed "For Industrial Services." The firm, who have been in existence upwards of fifty years, received the "Silver Government Medal" in the year 1904. That the recipients of the present honour are a progressive and representative firm connected with the gas industry is a fact on which the members of that industry in Germany may be congratulated, as it reflects credit on their whole body.

REGISTER OF PATENTS.

Heating Vertical Gas-Retorts.

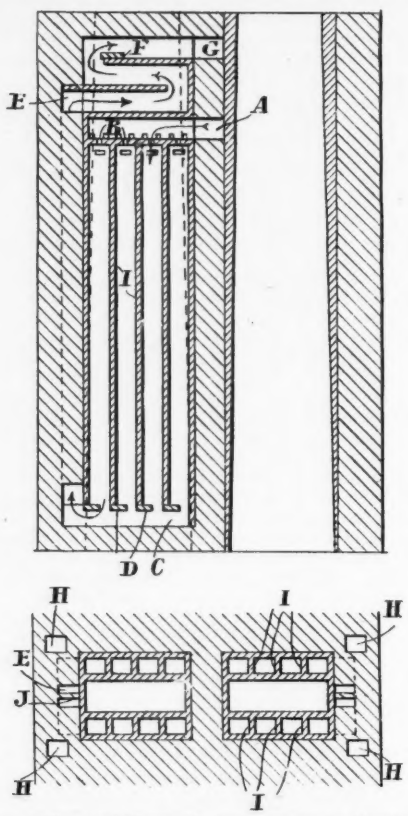
ROBERT DEMPSTER AND SONS, LIMITED, and TOOGOOD, H. J., of Elland.

No. 16,825; July 22, 1911.

This invention, relating to "continuous" or "semi-continuous" vertical gas-retorts, has for its principal object "to heat such retorts in the most efficient manner, so as to obtain a maximum production of gas and residuals with a minimum consumption of fuel."

Two streams of fuel gases are employed for heating the length of the retorts, travelling either upward or downward as may be found most advantageous—one stream heating the lower portion of the retorts and the other the upper portion. The maximum heat can thus "be applied to the portion of the charge where it will be most efficient in the production of good gas."

The patentees continue their specification thus: In a continuous vertical retort, which necessarily contains coal in every stage of carbonization at the same time, beginning with the cold coal at the top, in practice it is found that an empty space is sometimes formed at the top of the retort owing to occasional hanging-up of the coal in the feeding-hopper. Consequently, it is desirable to avoid applying the maximum heat to the extreme top of the retort, which would otherwise become overheated, and crack the gas on its way from the charge to the take-off opening; and, further, were the maximum temperature applied to



Dempster and Sons and Toogood's Arrangement for Heating Vertical Retorts.

the extreme top of the retort, much heat would be lost by excessive radiation losses through the bench top, which, besides wasting fuel, would interfere with the work of the stokers. It is also desirable that the coal, as soon as it enters the retort, should be quickly heated to a fairly high temperature, in order that the liquids formed may be quickly vaporized; otherwise these liquids would destroy the porosity of the cap of the charge, and thus hinder the free escape of the gases which are simultaneously being evolved in the lower part of the charge. "From these considerations, it appears that the top of the retort should be heated to a temperature intermediate between the temperature of combustion and the sensible heat of the products of combustion termed waste heat; the maximum heat being applied at a point some distance from the top of the retort, and the heating gases, or the main portion thereof, then travelling downward. The ring or annular wall of coke formed at the point of application of the maximum heat will then slowly conduct the heat to the central core of coal as they travel down the retort, assisted by the heat received through the walls of the retort, from the descending stream or streams of heating gases, until towards the base of the retort the mass of the charge will be fairly uniform and high in temperature throughout—a higher average temperature of the cross section of the charge being probably reached towards the bottom than at the point of maximum application of outside heat.

"Opinion is divided as to the movements of the particles of the charge in a continuous vertical retort—one opinion being that the central core, being of higher specific gravity and free from skin-friction against the sides of the retort, would descend faster than the outer ring, and that the side particles would continuously roll in towards the

centre. Our own experiments, however, show that, although this does occur in a hopper having an average cross-sectional area many times greater than that of its outlet, yet in a vessel of such proportions as our vertical retorts, this rolling tendency is practically non-existent; the charge moving downwards steadily, with only such slight displacements as are necessary to fill the varying cross section of the retort. This fact has an important bearing on the method of heating the core of the charge, as this core will be of coal surrounded by a ring of coke moving down the retort; the ring gradually becoming thicker and the core thinner until (about half-way down the retort) the coal disappears, and is merged in a complete cross section of coke of varying temperature—the central parts, of course, being the coolest. As the charge descends, further additional heat is imparted from the outer to the inner parts, and the temperature of the outer parts is maintained or augmented by conduction from the heating flues, until, towards the bottom, the complete cross section of the charge will have attained approximately uniform temperature, as before mentioned.

"In order to prevent the coal in the feeding-hopper becoming sticky by reason of the heat from the retort being conducted up the ironwork, the parts of the setting adjacent to the top of the retort may be filled in with fire-clay, and a fire-clay extension added to the retort mouthpiece; or the coal-hopper itself may be lined with non-conducting material.

"We preferably make the taper of the retorts sharper in the upper than in the lower portion, in order to provide for the expansion of the coal when first heated, and facilitate the uniform downward progress thereof."

Nine sheets of drawings accompany the specification, the first of which is reproduced—illustrating, as it does, "a method of heating the retorts in which the second stream of hot gases, heating the upper portion of each retort, is derived from, or is a continuation of, the first stream, which has heated the lower portion of the retort containing the hot coke, either stream being subdivided as found desirable."

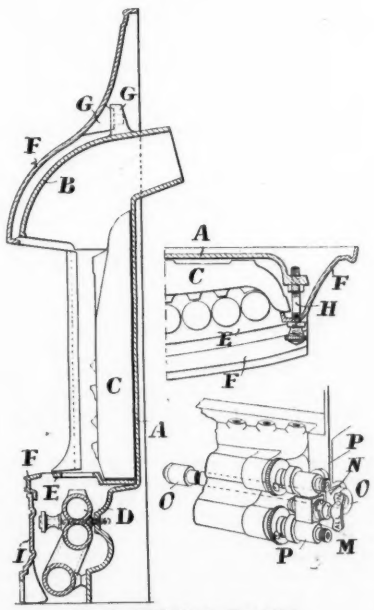
A is the flue supplying the producer gas, which meets the secondary air at the burners B. The stream of incandescent gases so produced heats the lower portion of the retort in its downward travel to the flue C, its entry to the flue being controllable by a damper or dampers D. Thence the hot gases pass up passages E to form a second stream, which proceeds about the upper portion of the retort, "which is thus heated to an intermediate degree, in accordance with the theory of this invention as before set out." The damper F controls the entry of this second stream of gases to the top flue, from which the gases pass through the port G to the regenerator. H indicates the secondary-air passages. If found desirable, the partitions I may be perforated and the dampers D may be dispensed with, in which case the function of controlling the entire draught through the heating chambers of one side of one retort is performed by the single damper F. The partition J may also be dispensed with, when the divided stream passing down the sides of the retort is re-concentrated in a single ascending passage E, "whereby the last traces of combustible gas which may exist in the stream coming from one burner will be burnt by excess air admitted by another burner, and the heat generated utilized on the retort as fully as possible."

Gas-Fires.

DAVIS, H. N., and TWIGG, W. R., of Luton.

No. 17,032; July 25, 1911.

This invention relates to a gas-fire in which the whole of the operative parts are separate from the ornamental front and readily attachable to it, and which shall be immediately ready for either right or left handed use.



Davis and Twigg's Gas-Fire.

The shell back, into which the brick and the incandescent fuel are fitted, is cast in one piece with the canopy or hood for collecting and leading the products of combustion to the flue outlet—avoiding the use of cement or other joints between the stove and the chamber for collecting the products of combustion. The front is secured to the stove proper by interlocking lugs at the top and two screw-studs fixed in the stove proper and passing through two holes in the front, near the foot—the front being pushed into position and secured by nuts. The fuel is attached as described in patent No. 15,381 of 1911, "rendering the fuel absolutely independent of the brickwork back—it being possible to fit a fire and work the same without even providing a brick back."

The illustration shows a sectional side elevation of a fire constructed according to this invention and fitted with a single burner (the fuel bars being removed); a sectional part plan of same; and a detail view showing the arrangement of the three-way cock as applied to a duplex burner.

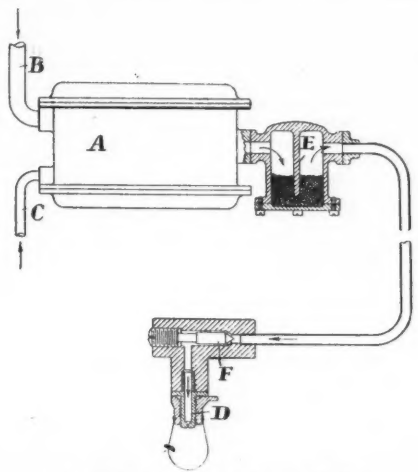
The shell back A is cast in one piece with the canopy or hood B. It carries the fire-brick C, the burners D, and the fuel columns (not shown), which are supported upon the plate E, held in place by the weight of the back and below which the burners are situated. The front F is detachably secured to the back by interlocking lugs G and a pair of stud bolts H screwed to the back and passing through holes at the sides of the front. The front has the usual removable fret I in front of the pit. The same three-way cock M is used whether a single or duplicate burner is employed; one way being stopped when only the single burner is used. The cock is T-shaped—the horizontal inlet screwing into a gas-chamber N connected to the inlets O, one from either side. The horizontal controllers P, with side inlets, are screwed direct into the outlets of the cock.

Gas Lighting Plants.

SVENSKA AKTIEBOLAGET GAS ACCUMULATOR, of Stockholm.

No. 23,209; Oct. 20, 1911. Convention date, Nov. 3, 1910.

This invention refers to safety devices to be used in connection with gas-lighting plants in which incandescent light burners are supplied with a mixture of gas and air under pressure, produced in mixing apparatus communicating with the burners. The object aimed at is to prevent explosion of the mixture of gas and air in the supply conduit caused by accidental flowing-back of the flame from the burner into the gas-mixture conduit; and for this purpose a safety device is arranged in the mixture conduit adjacent to the burner. To prevent explosion of the mixture of gas and air in the mixing apparatus should the safety device fail to act, another safety device is arranged in the mixture supply conduit adjacent to the mixing apparatus.



A Swedish Gas Safety Burner Device.

A is apparatus (of any suitable construction) for mixing combustible gas and air in desired proportions; B is the gas supply pipe; and C the air supply pipe leading to the mixing apparatus. In the conduit between the mixing apparatus and the burner D a safety device is inserted, consisting of a casing provided with a partition or depending wall E extending almost to the bottom, as in fluid-seal devices. The casing is partly filled with an easily-fusible finely-divided metal—such as lead in the form of small shot. The metal particles allow the necessary gas and air mixture to pass, although the spaces between them are so small as to prevent a flame burning in the conduit passing through the casing. If, nevertheless, the gas in the casing should be ignited, the metal will melt and form a fluid seal, which will effectively shut off the mixing apparatus from the conduit.

The safety device arranged near the incandescent burner consists of a pin F screwed into the gas-conduit so as to nearly fill up the gas-channel and only leave a narrow annular opening for the passage of the gas. The conical end of the pin regulates the quantity of gas flowing to the burner, and consequently the size of the flame. If the flame should by chance flow back in the gas-channel of the burner, it is not likely to pass through the narrow annular opening.

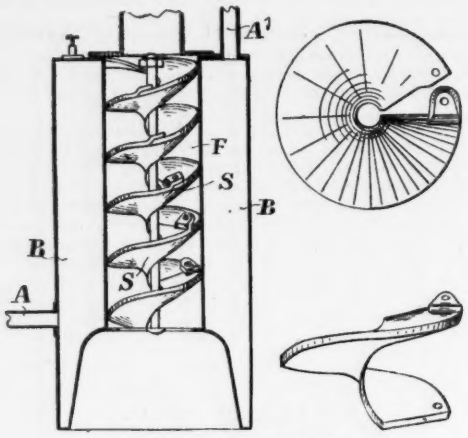
Heating Water by Gas.

WILSON, C. L., of Armley, near Leeds.

No. 28,996; Dec. 23, 1911.

The patentee's object is to construct a water-heater primarily intended for use with gas-ring burners wherein the flue for the escape of the products, which, in escaping, heat the water in the boiler, is of comparatively small diameter, and to arrange means in the flue to cause the heated products to repeatedly impinge on, or be continuously in contact with, the surface of the flue and so communicate heat to the

water, and at the same time form a continuous baffle in the flue in the shape of a spiral or worm adapted to direct the products of combustion on to the walls of the flue.



Wilson's Gas Water-Heater.

The illustration shows a section of a water-heater, and a plan and elevation of a portion of a baffle.

The boiler B has a central flue F communicating with a bunsen burner or series of burners. This flue is of comparatively small dimensions—say, 4 inches in diameter in an 8-inch diameter boiler. On a ledge or flange at the base of the flue (or suspended from the top) is a continuous spiral or worm S, curved slightly downwards from the outer edges to the centre, so as to direct the heated products of combustion towards the outer edges and cause them to impinge on the sides of the flue and impart heat to the water in the boiler. The spiral itself becomes heated, and by conduction and radiation its heat is transferred to the sides of the flue and thence to the water. The boiler has the usual feed and outlet arrangements A A^1 for the water. The worm S forms a continuous curved surface of half (or thereabouts) the diameter of the flue, or it may be built up in sections (as shown) adapted to fit on to one another so as not to break continuity. This construction is found most convenient and economical from a constructional point; there being five sections having securing means provided—such as flange and aperture—so that when fitted together they form a continuous spiral or worm. When (say) the lower section requires repair or removal, it may be replaced by a new section, or the old upper one take its place and a new section placed at the top as desired. A central rod passed down the centre of the spiral secures them in position.

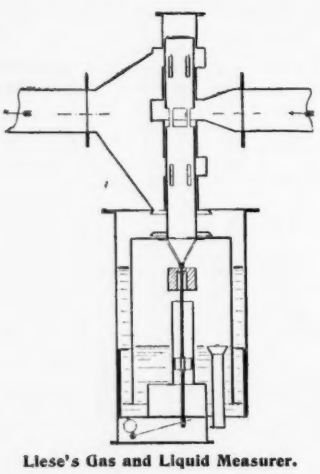
Another method of supporting the worm or spiral would be to groove the chimney or flue spirally, so that the projecting edges of the spiral fit therein (or rest thereon if the grooves project inwards) and the worm be placed in position screw-wise. This construction, while essentially adding to the cost of the apparatus, strengthens the flue and gives a somewhat larger heating surface.

Measuring Gases and Liquids.

LIESE, H., of Hamburg.

No. 27,467; Dec. 7, 1911. Convention date, Dec. 9, 1910.

This invention relates to apparatus for measuring gases and liquids of the type in which a hollow slide-valve is automatically adjusted into proper positions, to enable it to act as a measuring device by the difference of pressure before and behind the hollow slide-valve. The speed of gas or liquid passing through a pipe or other conduit is, the patentee remarks, dependent upon the size of the opening through which it



Liese's Gas and Liquid Measurer.

passes, and upon the difference of pressure before and behind the opening. "If with varying quantities the same speed prevails, the opening must be proportional to the quantities passing; and the same difference of pressure must be retained during the time any particular speed and quantity lasts.

The arrangement (as shown) consists in connecting this hollow slide-valve directly with a separate regulating device, which may be any suitable chamber capable of expanding and collapsing more or less according to the pressure exerted upon it internally and externally; the connection being effected in such manner that the pressures acting upon the inside and outside of the chamber are equal respectively to the pressures within and beyond the slide-valve. The expanding and collapsing chamber may, for example, consist of a cylinder and piston, a chamber with a flexible diaphragm, or a movable bell more or less immersed in a liquid. When the latter device is employed, and the steam of water is the substance passing through, and to be measured by, the apparatus, the condensation water coming from the steam is used as sealing means for the bell.

The invention consists further in providing the slide-valve with two separate sets of outlet ports arranged symmetrically with reference to the inlet port or ports, and opening into the same space in the slide-valve for the purpose of balancing the steam pressure within the slide-valve.

The patentee says he is aware that it is not novel to employ in apparatus for measuring gases and liquids a flat slide-valve as a measuring device in connection with a flexible membrane as a regulating device, nor is it novel to employ a hollow slide-valve as the measuring device in connection with a piston and cylinder as a regulating device; and he makes no broad claim to the employment of such devices in measuring apparatus of the kind referred to.

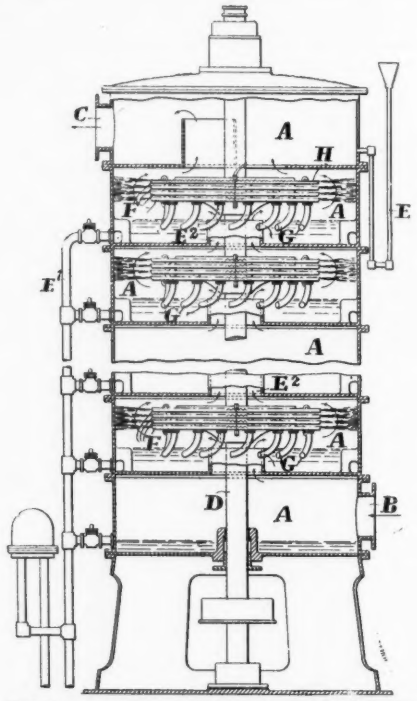
Effecting Intimate Contact between Liquids and Gases.

KIRKHAM, HULETT, AND CHANDLER, and SIDNEY HERSEY, of Palace Chambers, Westminster, and BLAKE, E. W., of Thornton Heath.

No. 23,813; Oct. 27, 1911.

This invention relates to improvements in the apparatus described in patent No. 18,129 of 1908, so as to render it more suitable for the treatment of dense solutions, such as those used for the extraction of cyanogen from coal gas.

To this end, the patentees, in lieu of a revolving tray provided with peripheral perforations, make use of a tray which has an upturned peripheral lip, the upper edge of which is either serrated or is of an undulated or wavey shape, or which is of flat shape without the upturned lip. Furthermore, they arrange in each bay of the apparatus a series (preferably four) of trays, superposed and each having its own depending scoops.



Kirkham, Hulett, and Chandler's, Hersey's, and Blake's Gas-Washer.

In the sectional elevation now given of apparatus for effecting intimate contact between liquids and gases of the kind described in the specification of their main patent but having the present improvements applied thereto, A represents the series of superposed bays constituting the apparatus, the lowermost bay having the inlet B for the gas, and the uppermost bay the outlet C. D is the shaft which extends through the superposed series of bays; being provided at its lower end with a pulley by means of which it can be rotated. E is the inlet pipe for the liquid to the topmost bay, E^1 is the discharge pipe in connection with the bottom of each bay, and E^2 is the central opening between the successive bays.

In each compartment the shaft carries a series of four superposed trays resting upon a collar keyed upon the shaft in the proper position in the bay. Each tray is made in four segments F, having lugs or flanges so that the adjacent segments of each tray can be bolted together. Each tray is provided with its own depending scoops G—one scoop being fitted to each tray segment; and all the scoops are

staggered relatively to one another. They may, however, be put in any other position relatively to one another that may be found to give good results in practice. Each of the trays is formed with an upturned peripheral lip H, either plain or serrated, or it may be of an undulated or wavey shape, or flat without the upturned lip.

Assuming that each of the bays or chambers A is provided with the requisite quantity of liquid, and that the shaft D is rotated, each set of superposed trays in the chambers will be revolved, so as to cause the scoops depending from them to pick up the liquid into which they dip in the bays. The liquid is forced up through the depending scoops into the trays, and, as these are shallow, is discharged over the outer edge —the "discharge taking place in the form of a thin, finely-divided sheet, or being scattered or broken up by the serrations or undulations of the upper edge of the upturned lips of the trays."

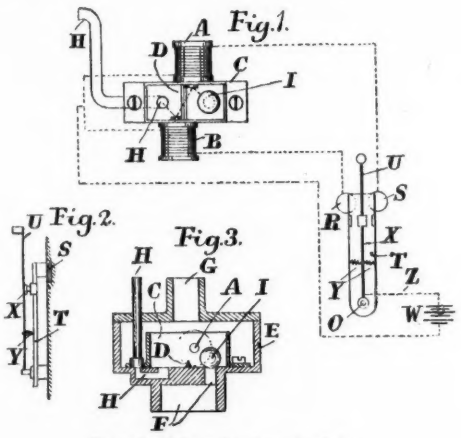
Electrically Operated Valves for Gas-Conduits.

THIEM, W., of Halle, Germany.

No. 29,140; Dec. 27, 1911. Convention date, June 17, 1911.

In connection with gas-conduits which are not used continuously, but at short intervals, and the valves of which are in some cases not easy of access, the operation of repeatedly opening and closing the valves, the patentee points out, causes much loss of time, and is at times very inconvenient. The electrically-actuated valves hitherto known are "unsuitable in such cases, by reason of the fact that they require too much electric energy, if they are to operate in a reliable manner, and the cost of maintaining them is therefore too high." The object of the present invention is to remove this disadvantage.

The invention is primarily characterized by the fact that the opening of the supply passage, closed by a ball of magnetic material, is not effected by a single electro-magnet, but by at least two electro-magnets which assist each other in their action in moving the ball. The ball is first attracted by one of the magnets, and then by the other, before it reaches the desired position. In order to prevent the rolling back of the ball to its seat on the orifice of the passage, by reason of vibration, a bridge-piece may be arranged between the two magnets, or a so-called "cage" surrounding the ball may be provided with curved or angular slots in which the ball is guided by bosses, so that after passing the crest of the slots the ball drops on to its seat. In this case, the ball may consist of non-magnetic material—the bosses being of magnetic material.



Thiem's Valves for Gas-Conduits.

Fig. 1 diagrammatically illustrates one form of the apparatus. Fig. 2 is a side view of the switch. Fig. 3 is a longitudinal section of the ball cage and valve-box, drawn to a larger scale.

A B are the two electro-magnets, the cores of which are fixed to the ball cage C, which, as already mentioned, is divided by a bridge D, preferably in the form of a knife edge. The cage, with the magnet poles, is enclosed in a valve-box E, which has a supply passage F and an outlet passage G. There may, in addition, be a branch passage or branch passages H, partly or wholly closed by the ball I when the supply passage is open.

The two electro-magnets are arranged symmetrically with regard to the bridge D, so that the distance between them and the distance between each of them and the adjacent passage F or H, is about one-third of the distance between the supply passage and the passage H. When the magnet A is energized, for opening the supply passage F, the valve ball I travels as indicated by the dotted line; being pulled first by the magnet A, and then by co-action of the electro-magnet B—the electro-magnet A being gradually de-energized and the magnet B pulling the ball across the bridge D, the ball being finally dropped on to the orifice of the passage H, when the magnet B is de-energized. For closing the supply passage, the ball is pulled along the same path, first by the magnet B and then by the magnet A, and is dropped on to the orifice of the supply passage.

The switch mechanism has contacts R S connected to the magnet coils, sufficiently close together to be at one stage both in touch with the slide-contact lever T, which is pivoted at O. On this lever is pivotally mounted an insulated switch lever U, the centre piece X of which is adapted to make contact with the two contacts of the lever T. Springs Y hold the lever U in its central position, and a wire Z connects it to one terminal of the current generator W, the other terminal of which is connected to the magnet coils. When the lever T is in the right-hand position, on the contact S, and the lever U is moved to the left, the circuit of the coil A is closed and the action already described takes place. When the lever T is moved so that it rests on both contacts R S, both the magnet coils receive current. When the lever is moved so far to the right that it only touches the contact R, the magnet A is de-energized—the magnet B remaining energized. On the lever U being then released, the valve ball falls, as described, on to its seat.

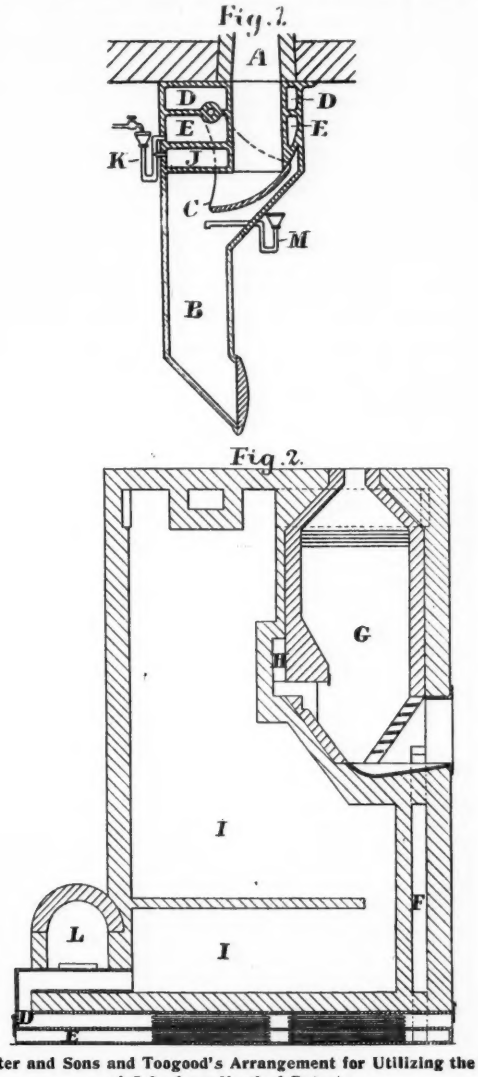
Utilizing the Residual Heat of Coke Produced in Vertical Gas-Retorts.

ROBERT DEMPSTER AND SONS, LIMITED, and TOOGOOD, H. J., of Elland.

No. 11,209; July 22, 1911.

This invention relates to continuous or semi-continuous vertical gas-retorts; and its principal objects are to cool the coke and to utilize as fully as possible the residual heat therein.

The patentees say: After the lower portion of the charge has been fully carbonized, the resultant coke is, of course, at a high temperature —in fact, much too hot to be dealt with by automatic extracting mechanism, and therefore requires to be cooled. According to our invention, we recover this residual heat from the coke and return it to the setting. For this purpose, we arrange flues enclosing the retort extension containing such coke, through which flues we circulate primary air; and we may also arrange a water drip in connection with the flues.



Dempster and Sons and Toogood's Arrangement for Utilizing the Heat of Coke from Vertical Retorts.

The water being evaporated, the air is thus caused to contain steam in definite proportions. The air and steam, being thoroughly mixed and preheated, are led to the producer. The cooling effect on the coke thus obtained, even considering the latent heat in the water when so vaporized, might not be sufficient to extract the heat therefrom, especially in the centre of the mass. We may, therefore, employ a U-tube or other convenient means for supplying a water drip on the centre of the coke; the steam thus raised passing up through the charge and producing an addition of water gas. An auxiliary flue or flues may also be provided for the partial preheating of the secondary air before passing to the regenerator; and where the secondary air is so heated, it is passed in the opposite direction to the primary air, so as to cool each retort extension to the same degree. The above flues will extract as much heat as can be profitably utilized in the setting; but to further cool the coke and cause it to contract, so as to facilitate its handling by the discharging mechanism, we may employ a third chamber, connected to the main flue and provided with a damper. By these means cold air would be circulated and the discharging mechanism assisted in doing its work.

Fig. 1 is a section through the mouthpiece of a retort; and fig. 2 is a section through the producer of a bench of retorts, illustrating, by way of example, means for carrying out the invention.

A is the retort, with a downward extension; B the discharging mouthpiece; and C a discharging device. The extension is wholly or partially surrounded by flues D E, and may, if desirable, be provided with ribs (as shown in fig. 2) to increase their contact surfaces. The primary air enters the flue E and proceeds through the flue F to the producer G; the gas from the producer passing through the flue H to the combustion chamber. The secondary air passes through the flue D to the regenerator I (of any suitable type). A chamber J may also be provided for producing steam; water being fed into the chamber through the pipe K. Or (as described earlier) the chamber J may be provided with a slide and connected to the main flue L, so that air may be circulated through the flue. The pipe K may also feed the flue E for producing steam in connection with the primary air. The pipe for giving a water drip on the coke before discharge is shown at M.

It has previously been proposed by others, the patentees remark, to heat secondary air by passing it about the lower parts of a retort; and it has also been proposed to heat the air necessary for combustion as a whole by passing it about the lower parts of a retort in which the contents require to be cooled before discharge—both primary and secondary air being heated to the same temperature and then divided into separate streams. However, as the secondary air, which must not contain water vapour, may profitably be heated to the maximum degree to which the spent charge is capable of heating it (say, 1000° C.), while the primary air, which may contain water vapour, can only be heated to a much lower temperature (say, 250° C.), it is obviously advantageous to effect such heating in separate flues; and also the relative quantities of each can be more accurately regulated when entering at equal atmospheric temperature than after having been heated and expanded to an uncertain extent. The arrangement of flues illustrated (although they do not limit the invention to the exact details) is considered preferable, because the secondary air in the first flue meets the hottest coke, while the primary air meets somewhat cooler coke, and the water in the primary air is able to absorb heat at comparatively low temperatures. This latter feature, of course, necessitates the separation of the primary and secondary air before being heated—such separation enabling the relative positions of the flues to be chosen as described.

APPLICATIONS FOR LETTERS PATENT.

18,048.—Barrett, S. R., and Thorp, T., "Gas pressure regulators." Aug. 6.

18,127.—W. M. Still and Sons, Limited, and Abbott, F. E., "Air-gas apparatus." Aug. 6.

18,169.—Munro, H., "Fluid meters." Aug. 7.

18,177.—Palmer, H. H., "Shade-holders for incandescent lamps." Aug. 7.

18,203.—Lake, H. W., "Lamps." Communicated from F. J. Beebee and O. J. Holt. Aug. 7.

18,255.—Wilson, W. A., "Gas-heated boilers." Aug. 8.

18,266.—Rossbach, R., "Vertical gas-burners." Aug. 8.

18,283.—Holman, S., "Retort-lid fastenings." Aug. 8.

18,342.—Weppler, R., "Seamless, braided, incandescent gas-mantles." Aug. 9.

18,354.—Parker, G. W., "Retort-settings." Aug. 9.

18,359.—Fischer, J., "Atmospheric gas-burners." Aug. 9.

18,395.—Foni, E., "Cold carburation of air or gas." Aug. 10.

18,439.—Hipkins, A. E., "Utilizing the inner circle of the flame from an incandescent gas-burner to produce light." Aug. 10.

18,450.—Wallace, R. W., and Wassmer, E., "Production of ammonia." Aug. 10.

Quality of Skegness Gas.—Complaints have lately been made of the quality of the gas at Skegness; and a resident is said to have initiated legal proceedings in the matter. At the instigation of Mr. J. H. Shelley, who has been prominent in the agitation, the Urban District Council have resolved to appoint an examiner to make tests periodically of the purity, illuminating power, and pressure of gas, and to report thereon from time to time to the Council.

South Lincolnshire Water Scheme.—The Local Government Board have sanctioned the purchase by the Spalding Rural District Council of the portion of the undertaking of the South Lincolnshire Water Company which is within the Spalding Union. The purchase includes an artesian well at Pinchbeck West, and mains laid in that parish and at Moulton. The works had been carried out by the South Lincolnshire Water Company as part of their scheme to supply the district from Spalding to Sutton Bridge, a distance of 17 miles; but they failed to complete the undertaking, and the matter came into the hands of a Receiver, who agreed to sell a portion of the works to the Rural District Council for £2500. In sanctioning the purchase, the Board do it on condition that the Council will carry out an offer originally made to supply any surplus water in bulk at a fair price to the other authorities in the district.

Wrexham and East Denbighshire Water Company.—At the recent annual meeting of this Company, the Directors reported that the receipts on revenue account in the year ended the 30th of June showed an increase of £225, compared with the preceding twelve months. The amount available for distribution was £7985; and the Directors recommended the payment of a dividend at the rate of 7 per cent. per annum on the consolidated stock, and of £4 18s. per cent. per annum upon the ordinary stock, both less income-tax. In moving the adoption of the report, the Chairman (Mr. J. Allington Hughes) referred to the fact that the present year marks the completion of forty years' service by the Engineer and Secretary (Mr. F. Storr) and the Accountant (Mr. R. Roberts), and said the Directors some few months ago considered that the great services rendered by each of these officials to the Company during this long period should not be passed unnoticed. They accordingly presented Mr. Storr with a service of silver and Mr. Roberts with a silver salver. He felt sure the proprietors would agree with him in thinking that the Directors did the right thing at the right moment, as all were well aware how efficiently the gentlemen named had at all times worked in the interests of the Company. [The presentation was noticed in the "Journal" at the time.] The report was adopted, and the dividends declared.

MISCELLANEOUS NEWS.

GLASGOW CORPORATION GAS SUPPLY.

The Accounts of the Department for the Year 1911-12.

The Treasurer of the Glasgow Corporation Gas and Electricity Departments (Mr. James Fleming) forwards a copy of the forty-third report to the Corporation by the Committee on Gas Supply, with the gas accounts for the year from the 1st of June, 1911, to the 31st of May last. In the "Journal" for the 6th inst. (p. 408), a brief *résumé* of the report appeared; but further particulars may now be given.

The gross revenue amounted to . . .		£924,102 10 7
and the gross expenditure to	£697,511 7 3	
To which is added depreciation written-off capital assets	67,946 7 1	
		765,457 14 4
The balance carried to profit and loss account being		£158,644 16 3
The Committee had to meet the following requirements during the year:—		
(1) Annuities on stocks	£21,397 19 0	
(2) Contribution to Glasgow Corporation loans fund, in respect of Glasgow Corporation 3 per cent. stock redeemable in 1921, issued in lieu of converted gas annuities	7,668 8 0	
(3) Interest on borrowed money, &c. . .	40,576 10 5	
(4) Sinking fund	61,498 1 7	
		131,140 19 0
Leaving a surplus on the year's operations of		£27,503 17 3
Which has been disposed of as follows:—		
(1) To reserve fund account	£8,372 8 0	
(2) To surplus revenue account . . .	19,131 9 3	
		£27,503 17 3

The interest payable to the Corporation loans fund in respect of money borrowed was at the rate of £3 4s. per cent., compared with £3 4s. 9d. per cent. for the preceding year.

The Committee applied £3208 11s. 5d. of the amount at the credit of the sinking fund to the extinction of £1009 10s. of £9 per cent. and £425 of £6 15s. per cent. gas annuity stocks; and the annuities formerly payable upon these stocks now cease to be a charge upon the revenue of the department. There has also been redeemed during the year by the application of moneys at the credit of the same fund, a further amount of £16,500 of loans raised under the Glasgow Corporation (Tramways and General) Order Confirmation Act, 1901. The amount added to the sinking fund for the redemption of loans and the redemption or conversion of annuities was £66,431. The sinking fund, with its accumulations, now stands at £992,759, of which there has been already applied in the redemption of borrowed money, £3 per cent. stock and annuities, £794,199: leaving still available for either of these purposes the sum of £198,559.

The Committee state that the market for residuals was favourable to the Corporation during the past year. The consequent increase of income from this source amounts to £26,676. The average price received per ton of coal carbonized this year being 5s. 2d., as compared with 4s. 6d. for the previous year—an increase of 8d. per ton. The quantity of coal carbonized during the past year was 687,542 tons, as compared with 675,580 tons for the preceding year—an increase of 11,962 tons.

The net sum realized from the sale of coke this year amounts to £118,710; being £14,132 more than that of the preceding year. The total quantity of coke sold last year was 298,729 tons, as compared with 289,476 tons for the previous year—an increase of 9253 tons. The average price received was 8s. 7d. per ton, as compared with 7s. 10d. for the previous year—an increase of 9d. per ton.

The quantity of gas made per ton of coal carbonized was 10,483 cubic feet, as compared with 10,437 cubic feet for the preceding year—an increase of 46 cubic feet per ton, equal to 31,626,932 cubic feet. The extra gas sold amounted to 120,986,234 cubic feet. The unaccounted-for gas this year is 9 per cent., as compared with 8·7 per cent. for the preceding year—an increase of 0·3 per cent.

After giving a long tabular statement as to the sales of gas in the various districts of the city and suburbs, the report continues: The reductions in price granted by the Corporation last year resulted in concessions to the consumers amounting, *in cumulo*, to over £27,000. Having regard to the favourable result of the year's operations, and notwithstanding that the coal required next year has been contracted for at prices in advance of last year, the Committee recommended that the scale of charges in force last year, with the exception of supplies through prepayment meters, be continued. Supplies through prepayment meters, 2s. 5d. per 1000 cubic feet—a reduction of 1d. per 1000 cubic feet.

During the period of the miners' strike, the delivery of coal by the contractors was suspended for five weeks; but with the assistance of some purchases of bing coal, the Committee were able to maintain the full supply of gas. The Committee advertised for tenders for coal to be supplied during the coming year, and have concluded contracts for the whole quantity required, at prices in advance of those of last year.

Advances in wages and increased holiday allowances were granted to the workmen in the department which will entail an additional annual expenditure of about £9000.

The works and mains were maintained in an efficient condition during the year out of revenue.

The greatest quantity of gas sent out during the year in twenty-four hours was 35,290,000 cubic feet. The maximum daily make was 31,016,000 cubic feet.

During the year, there was a net increase of 3860 meters. The number of ordinary meters in use on May 31 last was 217,523, as

compared with 221,613 for the preceding year—a decrease of 4090. The number of prepayment meters on the same date was 65,018, as compared with 57,068 for the preceding year—an increase of 7950. During the year 34,651 meters were repaired.

As from the 1st of March last, gas cookers, range fittings, and grills have been given on loan to domestic consumers free of hire. This will mean a direct loss of revenue of about £10,000 per annum; but it is anticipated that the increased revenue obtained from the sale of gas will compensate for the loss referred to. The number of cookers and grills on loan on May 31 was 100,693, as compared with 78,997 for the preceding year—an increase of 21,696.

Gas-heating appliances are now let out on simple hire; and it is expected that there will be a large demand therefor during next winter. The number of gas heating and cooking appliances sold during the year was 3962; and in addition to these 2784 gas-fires were supplied on the hire-purchase system, as compared with 1815 for the preceding year.

The number of gas-engines in use, and the total brake-horse-power, for this year and the preceding year were as follows—viz.:

	Number.		Brake-Horse-Power.
31st May, 1911	1523	..	19,206¾
31st May, 1912	1471	..	19,299½
Decrease . . .	52	Increase .	92¾

About 11¼ miles of new mains were laid during the year, which brought the total up to 1039 miles.

The Committee have pleasure (in concluding their report) in recording their appreciation of the efficient manner in which the work of the department has been carried out by the General Manager (Mr. Alex. Wilson) and the whole staff during the past year.

Memoranda of Gas Made, Sold, &c.

—	Year Ending May 31, 1911.	Year Ending May 31, 1912.
Quantity of gas made . . . cubic feet	7,051,165,000	7,207,621,000
Do. sold or accounted for . ,,	6,436,198,650	6,557,184,884
Do. unaccounted for . . . ,,	614,966,350	650,436,116
Do. do. . . . . per cent.	8·721	9·024
Average price received per 1000 cubic feet sold	1/11·375	1/10·754
Average price per ton of coal carbonized .	10/3·178	10/4·770
Cost of coal per 1000 cubic feet of gas made	11·80d.	11·90d.
Capital employed per 1000 cubic feet of gas sold	7/-	6/10
Coal in stock at beginning of year . tons	89,516	92,467
Coal received during year . . . ,,	678,531	657,047
Coal carbonized during year . . . ,,	675,580	687,542
Coal in stock at close of year . . . ,,	92,467	61,972
Quantity of coke sold . . . . . ,,	289,476	298,729
Average price received per ton of coke .	7/10·129	8/7·8
Quantity of coke sold, per ton of coal carbonized	8·869 cwt.	8·688 cwt.
Average price received for ammoniacal liquor and tar per ton of coal carbonized	4/6·139	512·528
Quantity of gas made per ton of coal carbonized	10,437 c. ft.	10,483 c. ft.
Quantity of gas sold or accounted for, per ton of coal	9,527 ,,	9,537 ,,
Quantity of gas unaccounted for, per ton of coal	910 ,,	946 ,,
Illuminating power of gas, in candles—prescribed	14 ,,	14 ,,
Illuminating power of gas, in candles—supplied	18·82	18·5
Number of public lamps—flat-flame . .	4,249	1,875
,, ,, ,, incandescent .	25,034	29,471
Number of stoves on hire	56,493	—
Number of stoves and grills on loan . .	22,504	100,693
Gas-fires sold—hire-purchase system . .	1,815	2,784
Gas heating and cooking appliances sold .	4,228	3,962
Number of meters in use—ordinary. . .	221,613	217,523
Number of meters in use—prepayment .	57,068	65,018
Capacity of holders—cubic feet	44,376,000	44,376,000
Greatest quantity of gas delivered in one day, cubic feet	35,585,000	35,290,000

LIVERPOOL UNITED GAS COMPANY.

Annual Report and Accounts.

In the report to be presented at the annual general meeting of the Liverpool United Gas Company to-day, the Directors state that the accounts for the year ended the 30th of June show that the total revenue was £624,961 and the expenditure £520,078; leaving a surplus of £104,883, which has been transferred to the credit of the net revenue account. After deducting the amount taken for the payment of the dividend declared in February, and the interest on the debenture stock, there remains a balance of £97,170, out of which the Directors recommend a dividend for the past half year of 5 per cent. on the ordinary consolidated stock, and 3½ per cent. on the 7 per cent. stock.

The accounts accompanying the report show that the total paid-up capital, including premiums, on the 30th of June was £1,650,665, out of £1,719,548 authorized; leaving £68,883 unissued. The amount raised on loan at the above-named date, including premiums, was £336,309, out of £380,000 authorized; leaving £43,691 unissued. The capital account shows that £1,986,973 has been raised, and £1,999,021 spent; showing an over-expenditure of £12,048. In the course of the year, a sum of £38,252 was laid out for new mains and service-pipes (£1446), meters (£17,696), cookers (£15,659), and fires (£3450). But from the above-mentioned total is deducted £13,813 for depreciation of cookers, fires, and meters condemned or destroyed; bringing the amount down to £24,439. The reserve fund stood at £125,000, and the cash in the bank on account of the officials' superannuation fund at £2437, at the close of the year. The following is the

REVENUE ACCOUNT.

Expenditure.

Year to June 30, 1911.		£ s. d.	£ s. d.
	Manufacture of gas—		
£262,899	Coals, including oil, dues, carriage, unloading, and all expenses of depositing same on works	260,144 4 1	
13,783	Purifying materials, water, and sundries	14,204 0 1	
6,996	Salaries of Engineers and Superintendents and officers at works . . .	8,012 18 4	
28,105	Wages and gratuities at works . .	43,183 12 4	
50,700	Repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, materials and labour, *less* old materials . . .	53,063 12 3	
£362,488			378,608 7 1
	Distribution of gas—		
14,351	Salaries of Surveyors, Chief Inspector, Inspectors, Assistant Inspectors, &c.	13,243 11 1	
15,693	Repair, maintenance, and renewal of mains and service pipes, including materials, laying, paving, and labour	18,343 3 8	
21,867	Repairing, renewing, & refixing meters	26,952 17 9	
6,765	,, ,, ,, fires and cookers	10,892 10 6	
			69,432 3 0
	Public lamps—		
1,702	Lighting and repairing	..	1,769 1 7
	Rates, taxes, and rents—		
730	Rents	705 16 11	
31,328	Rates and taxes	32,764 2 1	
			33,469 19 0
	Management—		
1,200	Directors' allowances	1,200 0 0	
8,743	Salaries of Secretary, Accountant, and clerks, office keepers, and messengers	8,263 13 11	
7,660	Collectors' commission and salaries .	8,025 16 5	
2,281	Printing, stationery, and advertising .	2,929 9 6	
1,977	General establishment charges and incidentals.	3,314 18 1	
158	Official Auditor	157 10 0	
21	Shareholders' Auditors	21 0 0	
			23,912 7 11
	Special charges—		
2,448	Law and Parliamentary charges. . .	281 14 10	
5,426	Contributions to superannuation fund, and allowances	6,456 11 1	
—	Co-partnership bonus	4,962 8 6	
526	Bad debts	388 14 0	
969	Insurances and compensations . . .	796 18 11	
			12,886 7 4
£486,533			520,078 5 11
146,073	Balance carried to net revenue account		104,883 10 0
£632,606			624,961 15 11

Income.

Year to June 30, 1911.	Sale of gas—	£ s. d.	£ s. d.
£387,052	Per ordinary meters at 2s. 1d. per 1000 cubic feet	358,381 6 10	
98,831	Per automatic meters at 2s. 8d. per 1000 cubic feet	109,715 19 5	
27,822	Public lighting at 1s. 10 5d. per 1000 cubic feet	24,426 8 1	
£513,705			492,523 14 4
12,881	Rental of meters	..	13,015 7 9
2,302	,, fires and cookers.	..	..
	Residual products—		
53,558	Coke (*Less* expenses) . .	65,303 14 10	
21,886	Tar ,, ,, . . .	21,501 9 2	
25,962	Ammoniacal liquor ,, ,, . . .	31,044 1 10	
1,587	Other products ,, ,, . . .	1,473 8 0	
725	Rents	. . .	119,522 13 10
			100 0 0
£632,606			624,961 15 11

The following statements relate to the working:—

Statement of Coal and Oil.

Description.	In Store June 30, 1911.	Received During Year.	Carbonized or Used During Year.	In Store June 30, 1912.
	Tons.	Tons.	Tons.	Tons.
Common	31,297	224,636	226,339	29,594
Cannel	6,809	29,750	31,770	4,789
Total . .	38,106	254,386	258,109	34,383
Gas oil—gallons . .	1,261,593	5,446,931	5,675,797	1,032,727

Statement of Residual Products.

Description.	In Store June 30, 1911 (Estimated).	Made during Year (Estimated).	Used in Manufacture during Year (Estimated).	Sold during Year.	In Store June 30, 1912 (Estimated).
Coke—tons	1,649	167,314	40,992	124,629	3,342
Tar—gallons	210,443	4,018,325	142	4,000,108	228,518
Ammoniacal liquor—gallons	360,638	7,656,470	*Nil*	7,606,837	410,271

SOUTH METROPOLITAN GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held last Wednesday, at De Keyser's Royal Hotel, Victoria Embankment, E.C.—Mr. CHARLES CARPENTER (the Chairman) presiding.

The SECRETARY (Mr. F. M'LEOD) having read the advertisement convening the meeting and the minutes of the last ordinary general meeting, the seal of the Company was affixed to the Register of Proprietors.

THE CHAIRMAN'S SPEECH.

The CHAIRMAN: Ladies and Gentlemen,—I have now to move the adoption of the report and accounts [see *ante*, p. 379]. A copy of them has been sent to every shareholder, and I assume you will, as usual, take them as read. The tale told by them may be summed up in the short statement that we should have had a very good half year but for the national coal strike; and the importance of this disturbing factor is so great that I must follow the report in giving it precedence in the remarks I have to make this afternoon.

THE COAL MINERS' STRIKE—DIRECTORS' FORESIGHT.

Those of you who keep a file of our half-yearly reports will have noticed that we have for the past four years amplified our practice with regard to the carrying of coal stocks. Instead of being satisfied with a mid-winter stock of from 100,000 to 130,000 tons, we increased this to, in round figures, nearly a quarter-of-a-million tons. Such a proceeding is, of course, costly, as a great deal of money has to be found to make the purchase. Moreover, coal does not improve in quality by storing; and, besides this, extra cost is incurred by reason of the fact that all stored coal has to be handled twice at least before it is carbonized in the retorts. But your Directors considered the course a wise one, having regard to the change brought about by the federation of all underground workers throughout the coal mines of the United Kingdom. Previous to this combination, our experience had been that if coal were unobtainable by reason of a strike in Durham, it could be purchased in Yorkshire, and if neither of these fields was available, then from other counties or even Scotland. But the federation brought us face to face with a new problem; and we endeavoured to meet it in the manner I have described. Our coal contracts run out normally at the end of March every year; and in the Spring of 1911 we purchased sufficient to last until the end of the half year just completed, or the 30th of June. But despite all our efforts, we were not able to obtain delivery of this quantity—mainly owing, so we were told, to bad working on the part of the miners, and, there is no doubt, of the prevalence of great unrest for some months before the actual strike took place. I fear that, to a large extent, the substitution of hard-and-fast legislation for the give-and-take arrangements entered into between the masters and men was very largely responsible for this shortage of output. I may give you an instance. A case which was reported in the Press, where a father and a son lived together and worked together in the same pit. The son left off work at six o'clock one morning; and it was his father's duty to go down the mine nine hours afterwards. He was taken ill; and the son thought he would perform his work for him, and did so. For this breach of the Act, he had to appear at the Police Court and pay 7s. It must necessarily take time before workers who have been used to freedom of action settle down to work under the altered conditions devised by Parliament, and with which many of them are in disagreement. Well, try as we could, for several months preceding the stoppage, we could not obtain our full requirements of coal; and when the strike was declared, we had sufficient stock for somewhat more than two months' consumption, instead of three months. I may here remind you of the admirable description which the Prime Minister applied to the coal-mining industry when he spoke of it as being the life-blood of the Nation. Week after week went by and saw our reserves of this steadily diminishing; but still the strike showed no signs of terminating. We had then a choice of two alternatives. We might have fallen back upon our legislative obligations, and by a reduction in quality or quantity, or both, economized in our gas production, and so maintained our stocks for a much longer period. We should have complied with the letter of the law under which we work; but we should have caused a large proportion of our consumers great inconvenience if we had in this manner passed on to them as much as possible of the burden. We chose the alternative of replenishing our supplies from abroad, and maintaining the quality, the purity, and the pressure of our gas as if nothing were happening. The course adopted was a costly one.

PURCHASE OF COAL FROM ABROAD.

We bought from Nova Scotia, from the United States, and from Germany; and though the price we paid was exceedingly high, I am glad to say that the coal which crossed the Atlantic was of excellent quality, and was carbonized in our retorts with the same facility and the same yields as if it had come from Durham or Northumberland. The results justified our expectations. As regards our supply of gaseous fuel, and solid fuel in the form of coke, South London was unconscious of the strike; for our stocks enabled industry and domesticity to continue their normal courses, unchecked and untaxed by a conspiracy which threatened to paralyze them both.

SECURING THE CONFIDENCE OF CONSUMERS.

There is no doubt that this Company will have, nay has, its reward in the strengthening of the confidence which our customers have in us. Confidence has been described as a plant of slow growth; and it is pleasing to feel that the crisis through which we have passed has not checked, but, on the contrary, encouraged its development.

THE BILL OF COSTS.

Of course, the time came when a bill of costs had to be presented; but it was obvious that such exceptional conditions were entitled to exceptional treatment. The insurance fund provides, *inter alia*, for this very happening; and the Official Auditor, before whom the facts were laid, raised no obstacle to the proposition that we should debit the fund with the major portion of the costs; and this, as you will have noticed from the balance-sheet, we have done.

EXPORTS OF COAL.

Before I finish with the coal strike, I ought to mention one other matter. We urged the Premier that when the life-blood of the country again began to circulate, its first flow should be retained for the sorely stricken industries of Great Britain by the prohibition of exportation until these were again fairly started. We had an acknowledgment of our letter, but nothing more; and, later, as soon as the stoppage came to an end, we had the mortification of knowing that ships were being loaded with the precious freight we needed, destined for France, Italy, Germany, and Scandinavia.

COAL PRICES IN FUTURE.

What are the future prospects of fuel prices? The present position is entirely an artificial one, resulting naturally out of the dislocation of business arising from a complete cessation of output by the largest coal-producing country in the world. Some, not much however, of the unraised coal has been done without. But the leeway of industry must be made up; and until this is overtaken, we cannot wonder at, though we may disagree with, the policy of the coal producers in taking every advantage accruing from the after-effects of the disturbance, not only to replace the great losses they incurred but to obtain besides something to the good for themselves. In one particular, they owe the gas and allied industries a substantial debt—in that, being forewarned, a very large amount of money was sunk in coal stocks by those responsible for their management; and the coal masters were thus enabled to hold out for, and eventually obtain, a fair settlement, instead of one hastily patched-up, which would have too heavily handicapped their business.

GENERAL MATTERS.

Well, ladies and gentlemen, I fear I must have wearied you by so long a reference to the two opening paragraphs of the report; but their importance must be my excuse. Putting them on one side, there is little to say except to congraiulate you upon the half-year's satisfactory figures. We have been able to substantially increase the amount we carry forward; we have had a good increase in the consumption of gas; and we have maintained the high level of our carbonizing results. The purification process about which I spoke to you six months ago has in the interval continued to fulfil the high expectations formed of it. Some 225 million cubic feet of gas have been treated by the plant without it showing any signs of falling off in efficiency. The completion of our next and larger installation has been delayed owing to the difficulty in obtaining manufactured steel; but unless any unforeseen trouble arises, it will be started and put to work in the late autumn. If it works well through next winter, we shall in 1913 proceed to apply the process to the whole of our gas production, with results which cannot but be advantageous to consumers, and without any sacrifice in the health and comfort of our workpeople or our neighbours. You will remember that Sir George Livesey told you on many occasions of the way the men suffered through the working of the "blue billy;" but by this process we shall do better than the "blue billy" process permitted us to do without any harm or ill-effects to the surrounding districts. This is a very important thing, having regard to the fact that half the gas production takes place in districts that are surrounded by dwelling-houses. Two improvements in apparatus for gas lighting have proved their merit during the past six months. The indoor inverted mantle burners I described to you in February last are now in use to the extent of over 25,000, and have easily maintained their superiority over all other patterns. High-power gas-lamps have now become so popular that orders for their extension come to us unsought—a valuable testimonial in these competitive times. When we are looking out very keenly for new business, and other companies are doing the same thing, it is a very high compliment to any particular form of gas appliance when the orders for it come to us without the seeking. That is the case with high-pressure lighting, which has now become so popular for street lighting and shopping areas in our district. This form of lighting has indeed become the standard of outdoor illumination; and, though it is perhaps rash to prophesy, it is one which does not seem likely to be excelled.

SUPERANNUATION AND PROVIDENT FUNDS.

Before concluding, I must refer to the two matters mentioned in paragraphs six and seven of the report. The first relates to superannuation. We have already two funds for this purpose—an officers' and a workmen's. But we have another class of employee who cannot strictly be considered to belong to either. I refer to those weekly servants who occupy the responsible positions of foremen, inspectors, &c. We have for many years past acknowledged our indebtedness for their faithful service by granting them a special retiring allowance when the time comes for them to lay down what is generally an arduous burden. These allowances have hitherto been paid under the heading of labour charges; but it was felt it would be a better principle to establish a special fund for the purpose, as a supplement to the already existing workmen's fund, and this your Directors have done. The last matter I desire shortly to deal with this afternoon concerns our provident fund for sickness, which was founded just seventy years ago. Although it was a purely voluntary affair, I do not think that we had a single one of our employees who did not subscribe to it; and perhaps this affords some explanation why they endeavoured, by might and main, to obtain exemption from the provisions of the National Insurance Act. They were, as you may remember, unsuccessful; and when I last had the honour to address you, I stated that they had reluctantly come to the conclusion that our admirable fund must cease to exist. Fortunately our difficulties were shared by many others; and by virtue of the very wide powers of (shall I say interpreting ?) the Act vested with the Commissioners, regulations have been approved which, with some necessary modification, we are not without hope may be accepted in our

case. An able Committee of our men have worked strenuously for this object; and I hope I may be able to tell you at our next meeting that their efforts have been crowned with success. When I tell you that their action was approved unanimously at every meeting of our employees which has been held, I think I may fairly claim this attitude as a testimony to the trust and confidence they have in us and which was my predecessor's happy theme, as it has been mine, at so many of these meetings. I have now to move: "That the report and accounts now presented be received and adopted and the report entered on the minutes." In the unavoidable absence of the Deputy-Chairman, Mr. John Ewart, who is convalescent after a serious operation, and is now, I am delighted to say, on a fair way to recovery, I will ask the senior member of the Board, Mr. John Mews, to second the resolution.

Mr. JOHN MEWS having seconded the resolution,

The CHAIRMAN said the report was now open for discussion by the shareholders.

A SHAREHOLDER'S REMARKS.

Mr. WEST, referring to an item of £4660 in the insurance fund for depreciation of investments, asked if this was the only amount they had taken into account within the last few years. He had looked through the Company's previous balance-sheets, but could not find any other amount. Then, with regard to the sum of £75,000, was this the actual loss the Company had sustained by reason of the extra charge they had had to pay for coal? The carry-forward on the insurance fund was £21,000; while in previous years they had carried forward something like £91,000. If they had another coal strike, this old insurance fund would be wiped out altogether. What were they going to do with this fund in the event of another strike? Was it not merely a fund to wipe out any losses?

The CHAIRMAN: If no other shareholder desires to make any observation, I will reply to the questions asked. We have twice in the last four years, since 1909, written-down the value of our securities. We have written-down the value of the securities in which our insurance fund was invested in the same way as we have written-down the securities in which our reserve fund has been invested. With regard to this particular fund (the insurance fund), the Act of Parliament under which it was created expressly provides for contingencies of this kind—that the fund may be used in case of a strike. We are not likely, of course, to have a strike of our own men—that is fortunately eliminated from even possibilities for good and all; but we might have another coal strike. Experience, however, of such strikes is that they generally happen once in a generation. Then another generation comes along who have not had experience of the misery and suffering entailed thereby, and a strike is suggested by them. We have been building-up an insurance fund since 1890, when it was seriously depleted; and we propose in the future appropriating half year by half year, as occasion offers, such amounts to the insurance fund as we think requisite and justifiable. It is very unlikely indeed that we shall have another coal strike for some time; but supposing the unexpected did soon happen, then we should have to charge a larger amount of the loss occasioned to us by it to our revenue for the particular half year in which it happened. I think I have answered all the criticisms made by the shareholder; and I now put the resolution.

The resolution was carried unanimously.

THE DIVIDEND.

The CHAIRMAN: I have now to move: "That a dividend at the rate of £5 9s. 4d. per cent. per annum be now declared, and that the warrants be transmitted to the registered addresses of the proprietors by post." The dividend of £5 9s. 4d. is the standard one to which we are entitled with gas at its present figure (2s. 2d. per 1000 cubic feet). I will ask Mr. Waterer, the recently-elected Employee-Director, to second this resolution.

Mr. JAMES WATERER: I have pleasure in seconding the resolution.

The resolution was then put and carried unanimously.

The CHAIRMAN announced that this concluded the business.

VOTES OF THANKS.

Mr. G. HOWLETT proposed a vote of thanks to the Chairman and the Board for the exceptional efficiency with which they had carried on the business of the Company during the past half year. Many of the shareholders who sat at home at their ease while receiving the £5 9s. 4d. per cent. on their shares had very little idea of what the gentlemen on the Board had had to contend with during the last few months. He happened to know a great deal about it; and it said a lot for the Chairman and the Board that they had come through very trying times in such an extraordinarily efficient manner, and had given them the same dividend as before. His friend Mr. West was a little anxious about future dividends. He (Mr. Howlett) was not—he had the greatest confidence in their Chairman and Board, and he was perfectly certain no one need have the least fear that the dividends would be depreciated in the slightest degree.

Mr. WEST, in seconding, said it was, of course, only for his own information that he asked the questions. He had the greatest confidence in the Board, and he felt certain they were doing the best they possibly could do.

The resolution was put and carried unanimously.

The CHAIRMAN: Ladies and gentlemen, for myself and my colleagues allow me to say that we are very much obliged to you for your kind vote of thanks and for the manner in which you have approved of the Board's action under trying circumstances. We were hopeful on more than one occasion that the time was at hand when we should see our way to reduce the price of gas; but this unfortunate strike, which did nobody any good and was not wanted, has had its effect upon our business, as it has had on hundreds of other businesses throughout the country, and has postponed any reduction for the present. We are not, however, without belief that the future holds for us a lower standard of price than that at which we are now selling gas. Before sitting down, I take this opportunity to propose a hearty vote of thanks to the staff—both engineering and clerical—for the manner in which they have conducted the business of the Company during the past six months. The attention the engineering staff have to give gets closer and closer every year, because the opportunities for improvements get gradually less the nearer we achieve perfection. To the clerical staff, I need not remind you, we are more and more under obligation every year which passes through the manner in which our relationship with our consumers is maintained. One of the lessons of modern gas supply we have learnt is that we have not only to manufacture gas but to sell it; and you cannot sell it unless you are on the best of terms with those who are your customers. I am very glad to say that our staff have not only maintained, but are increasing, their very high reputation in this respect; and I ask you to pass a cordial vote of thanks to the technical and clerical staffs for the way they have carried on the business during the past six months.

Mr. SAMUEL SPENCER seconded the motion; and it was carried with acclamation.

The CHIEF ENGINEER (Mr. W. Doig Gibb), replying on behalf of the engineering staff, said he had really nothing to report, except the continued conscientious and good work on the part of the technical staff. He thanked the shareholders for their recognition of their services. Everything had been carried out smoothly. The only outstanding feature that had occurred during the past six months was one which had given them all considerable satisfaction, and that was that co-partnership had undoubtedly been the means of making some 6000 of their employees work splendidly through all the period of labour unrest.

The SECRETARY (Mr. F. M'Leod), on behalf of the clerical staff, said it was always gratifying to them to know that they had the confidence of those whom they served. His colleagues upon the clerical and commercial side of the business appreciated this expression of approval very highly indeed, and in their name, and on his own behalf, he thanked the shareholders for their kind vote.

The proceedings then terminated.

CROYDON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Offices, Katharine Street, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. W. Topley) read the notice calling the meeting; and the report of the Directors and the statement of accounts were taken as read.

MR. WOODALL ON HOLIDAY.

The CHAIRMAN, in moving the adoption of the report and accounts, said he had, in the first place, on behalf of two of his colleagues, to express to the proprietors their regret that circumstances prevented them being present on this occasion. Mr. Woodall was in Scotland taking a rest from the strenuous work which fell upon him this year, in which, besides the engagements connected with the centenary celebrations of the great undertaking which he controlled, there devolved upon him the manifold duties arising from his office as President of the Institution of Gas Engineers, the Society of British Gas Industries, and the British Commercial Gas Association. The latter body, which would in October hold its first annual meeting, brought to a common point the energies of both the others on behalf of the development of the gas industry as a whole; and it was a happy augury for the future that one mind, and that so keen and practical as Mr. Woodall's, was guiding the deliberations of all three Associations. The gain was theirs and that of the industry at large. The unique distinction was one on which they might, he thought, offer their congratulations to Mr. Woodall. Mr. Percy Hall was taking a holiday abroad; and though he kindly offered to return for the purpose of attending the meeting, the proprietors would not, he was sure, have wished him to interrupt his holiday.

THE COAL STRIKE.

The past half year, he (the Chairman) need hardly say, had been one of constant, and at times grave, anxiety to those responsible for the administration of gas undertakings. Firstly, there was the coal miners' strike, and, secondly, the strike of the London lightermen, which disorganized their supplies of coal and oil, and necessitated the closest watching of stocks, as well as the most careful adjustment of methods of manufacture, to avoid the risk of failing to supply the consumers. The proprietors were aware that the Company had been able to maintain an uninterrupted supply of gas at full pressure. The fact that this Company, and other gas companies, had been able to do this had undoubtedly done much to mitigate inconvenience, and to save expense, to householders; and the gas industry, as a whole, might claim in this matter, by its foresight and organization, to have deserved well of the public. The good increases which they, and many of their neighbours, were able to report—in the case of their own Company, 7·34 per cent.—was some measure of the value of the services they had been able to render. These services, however, had not been without extra cost to the Company. To obviate the risk of the coal supply failing, it was found necessary to purchase several consignments of coal at prices much above those of their contract—in one case, more than twice the contract price. The increased price of these purchases cost the Company some £2000. Moreover, it was necessary to adjust the proportions in which coal gas and carburetted water gas were made, with a view less to economy of manufacture than to husbanding their resources. That, under the conditions, the working results had been so good was a circumstance reflecting much credit on the ability and constant care and watchfulness of their manufacturing staff.

POPULARITY OF GAS-STOVES.

The Directors had again to report a very satisfactory increase in the number of stoves in use; there being for the half year an increase of 2181, or for the twelve months of 4351. Few things illustrated in a more striking way the possibilities of increase in their business than did the development which had taken place, during recent years, in the use of gas for cooking and heating. He found that ten years ago they had on hire 53 stoves to every 100 meters in use. Five years later, the number had increased to 60; and in the five years just ended, it had

risen to 78. The percentage was thus, as against ten years ago, half as much again.

EXTENSION OF SUPPLY AREA.

The proprietors would see by the report that the Board had decided, at the request of landowners and residents in Woldingham, to extend the mains into this district. The expenditure would be considerable. But the Directors had assurance that it would shortly become remunerative; and they expected in the near future to see substantial developments of their business in the district.

ADVANTAGE OF AMALGAMATION.

Under the arrangement embodied in the Act of 1905, whereby the Company acquired the undertaking of the Caterham Gas Company, the price in this district had now been reduced to 2s. 9d.—that was, within 4d. of the price in Croydon. Considering that prior to the amalgamation the price in Caterham was about 3s. 9d., the district had gained a very considerable advantage; the price now being 1s. lower than in 1905, as compared with 3d. lower in the remainder of their area of supply.

THE STRIKE AND A COKE RESERVE.

Referring to the accounts, it would be seen that less coal and more oil had been used to produce 34½ million cubic feet more gas; the cost being practically the same for the larger quantity. As against this, however, was to be set a drop of £2300 in the receipts from coke. This was due to the smaller quantity produced; the price realized showing an advance of nearly 1s. per ton. In the early days of the coal miners' strike, when it was uncertain how far a "fuel famine" was to be apprehended, the Directors were approached by their esteemed and public-spirited fellow townsman, Sir Frederick Edridge, with a view to ensuring that, in case of need, the poorer residents should be able to obtain a moderate supply of coke without having to pay famine prices. The Directors cordially fell in with his suggestions, and reserved for this purpose a considerable stock; provision for its proper distribution being made through the co-operation of the school teachers in the borough. Sir Frederick Edridge guaranteed the Company against loss on its ultimate sale should it not be found to be needed for this purpose. Fortunately, no severe shortage of fuel was experienced in the town. The reserve of coke was drawn upon only to a limited extent; and the unused balance was sold without loss. The only cost of the arrangement was the fact that the Company might have been able, when the strike was at its height, to have sold the coke to outside districts at an enhanced price. Nevertheless, he thought the proprietors would approve the action which the Company took in this matter.

WORK IN THE DISTRIBUTION DEPARTMENT.

There was a considerable increase in expenditure under the head of distribution, partly due to the increasing use of stoves to which he (the Chairman) had referred, and partly to the increasing services rendered by the Company to consumers in seeing that gas was, or could be, used by them to the best advantage. Expenditure of the latter kind should be regarded as of the same nature as a reduction in the price of gas—in fact, it was of much greater value to consumers than would be a reduction of equal amount. Gas was purchased as a means to an end—that end being to obtain light, heat, or motive power. It was no exaggeration to say that the improved methods available to consumers now, as compared with (say) twelve years ago, for lighting and heating, enabled as much duty to be obtained from 1 cubic foot of gas as could then have been got from 2 cubic feet.

OFFICE AND SHOW-ROOMS EXTENSION.

He mentioned, at the previous meeting, that it was intended to use part of the land, adjoining the offices, which was acquired last year, for the purpose of extending the Company's buildings; and a part would be devoted to street widening. This would greatly improve Katharine Street, and the approach to the offices from Park Lane, while they would also be able to considerably extend the display made of apparatus for the use of gas. The plans for the extension had now been almost approved by the Directors; the work would shortly be commenced; and he hoped would be rapidly proceeded with. When finished, their offices would be a greater credit to the town than now.

NATIONAL INSURANCE.

The proprietors would have seen mention in the report of the action taken to meet the situation created, so far as the Company's men were concerned, by the National Insurance Act of last year. This Act had had in their case at least this pleasing feature: It had brought into strong relief the mutual goodwill and confidence which characterized, and had for many years characterized, the relations between the Company and their employees. The men had in the past, as the proprietors were aware, been provided for in case of illness by a sick fund, to which the Company had subscribed. This fund embraced all the workmen; and the provision made by it had been more favourable in several important respects than the benefits which the Act was designed to give. To secure to the men the continuance of their present position, the Directors offered to form a supplementary voluntary fund; and their suggestion was cordially adopted by the men, practically all of whom had become members. The Company would under this arrangement bear, in addition to their previous contributions, the burden placed by the Act upon employers; and the men, contributing under the Act and to the fund, would gain several benefits in addition to those which they had heretofore enjoyed. There was this further matter to be considered. The men, having been in the position of receiving through the Company adequate allowances during illness, very few of them had become members of friendly societies; and it was felt that they might appreciate an arrangement whereby their membership of an "Approved Society" under the Act might be facilitated. It had, therefore, been arranged by them that a branch of the National Deposit Friendly Society should be formed among them for the purposes of the Act. This was a matter in which, strictly speaking, the Company, as employers, were not concerned. But the proprietors would, he was sure, be glad to know that the assistance given to the men in the formation and conduct of this branch had been appreciated. He understood that more than 500 of their employees, or nearly all who came under the Act, had decided to join the branch, the affairs of which would be administered by a Committee elected by themselves.

PROSPECTS.

Turning to the immediate prospects. They were entering upon a period when coal, oil, and practically all the materials employed in their business would be much more costly than they had been. So far as this was due to a general improvement in the trade of the country, they would no doubt indirectly benefit; and as they saw no necessity, at all events for the present, for raising the price of gas (the reserves enabling them to face the extra expenditure for some time to come), the Company would be selling a fuel which would have even greater advantages in comparison with coal than in the past. During the current half year they would not feel the full burden of the increased cost of coal. The Company had their stocks, purchased at the old prices, and also considerable arrears of deliveries on old contracts to be made up, while they could look forward to gaining some benefit from the increased value of residuals.

THE PROFITS.

The profit for the half year to June had given them a surplus over the amount required for dividend of more than £8000. He might remark in parenthesis that but for their special purchases of coal, and the reductions made in the price of gas, they would have had by far the largest profit they had ever made in any half year. Of the surplus they did obtain, £4000 had been devoted to writing out of capital account plant disused at Carshalton and Caterham, £2000 had been transferred to the renewal fund, and the remainder went to increase the carry-forward, which, after payment of dividends, would now stand at £21,785, or nearly sufficient to pay the next half-year's dividend.

The DEPUTY-CHAIRMAN (Mr. Thomas Rigby) seconded the motion. He remarked that, as the Chairman had truly said, this was one of the best half years the Company had had—at any rate, during his (Mr. Rigby's) own immediate knowledge of the concern for the last twenty years. When the proprietors remembered the additional amount they had had to pay for coal, the extra wages, the reduction of the price of gas, and the amount allocated to co-partnership, they would agree that the accounts were exceedingly favourable.

THE CHEMICAL CLAUSE.

Mr. PORTER observed that, in certain Gas Bills which had been in Parliament this session, a clause had been inserted known as the chemical clause. He asked whether this would affect the Croydon Company, or whether the matter would be held in abeyance until the Company went for further powers.

The CHAIRMAN replied that it would not affect the Company until they went to Parliament. The matter might be raised then; but at the moment it was quite an open question as to what Parliament would do in the matter.

The motion was unanimously carried.

Mr. WILLIAM CASH also referred to the subject of the chemical clause in moving the declaration of the dividends. Regarding the resolution, its terms were that dividends for the half year should be declared at the rates per annum of 15 per cent. on the "A" stock, 12 per cent. on the "B" and "C" stocks, 5 per cent. on the "D" stock, and 10 per cent. on the "E" stock, all less income-tax. He said that, on referring to the net revenue account, the proprietors would see that, after paying the sums to which the Chairman had alluded, there remained a balance of £45,309. Of this, the dividends would absorb £23,524, and would leave a carry-forward of £21,785, which was an increase of £2100. As the Chairman had also mentioned, they were putting £2000 to the renewal fund. It might interest the proprietors to know that the time would soon come when they would have to bring up to date the purifying plant in the older section of the works at Waddon. It was well to know that this, in accordance with the terms of their Act of Parliament, had been provided for by anticipation; and that the renewals fund now reached over £9000. With regard to the chemical clause, he might explain that the Alkali Manufacturers' Association had induced Committees of both Houses of Parliament to insert the clause in a number of Bills. It restricted dealings in residual products; but it was a satisfaction to know that since the clause was introduced it had been decided that a Joint Committee of the two Houses should sit, and consider whether or not the practice of introducing the clause should be continued. At the present moment, the Croydon Company were not affected.

Mr. SAMUEL SPENCER seconded the motion, which was unanimously passed.

Mr. JOHN JONES moved a hearty vote of thanks to the Chairman and Directors, who had, he said, during the half year piloted the Company through a great deal of trouble, in which mistakes might have involved the Company adversely.

Mr. A. W. OKE, in seconding the motion, emphasized certain of the points in the Chairman's speech, and said the proprietors could safely leave their affairs in the hands of the Board with the prospect that the prosperity of the Company would continue.

The motion was cordially adopted.

THE ILL-HEALTH OF MR. HELPS.

The CHAIRMAN, in replying on behalf of himself and colleagues, said it had been truly said that this was one of the most anxious half years they had experienced; and he hoped that he should never experience the like again. After the coal strike, when they could obtain coal from the pits, they could not get it from the docks; and all the Directors could do was to have it transferred from the pits the whole way by rail. This had cost them much more money than it would have done by obtaining coal in the usual way. The feeling of the Directors was that it would be better to be left with coal in stock than to be called upon for gas without being able to meet the demand. Proceeding to move a vote of thanks to the officers, staff, and workmen, the Chairman said he was sure the proprietors would feel very great regret that their General Manager and Engineer (Mr. James W. Helps) was unable to be with them

that day. He was, he (the Chairman) was pleased to say, a little better; and they hoped that, with the continued rest he was taking—a temporary rest at the seaside, and then after that the Doctor recommended a voyage—when the winter season commenced, Mr. Helps would again be with them restored to health, and able to renew his services to the Company. During Mr. Helps' absence, the heads of the departments had entered most strenuously into their work, so as, if possible, to compensate for Mr. Helps' absence. Mr. Topley had done all he could possibly do to assist in his department, and sometimes out of his department. The Company were fortunate indeed in having at their works Mr. Caddick, who had been with them for some years, and would be with them, he (the Chairman) hoped, many more years. He had taken Mr. Helps' place; and, as the proprietors had seen from the results placed before them that day, he had fulfilled his duties with credit to himself and with pleasure to the Directors and to the proprietors. Mr. Sandeman, their Distribution Superintendent, had not been very well. He was such a "turk" for work. He had, however, been away for a change, and was returning that day, quite restored, he (the Chairman) hoped, to health. All the other members of the staff had done their best; and between them all and the workmen, the utmost good feeling prevailed. He was sure the workmen felt the Directors did all they could, under the circumstances, to make their lives as bright and happy as possible.

Mr. W. J. Russell seconded the motion, which was heartily passed.

Mr. Topley, on behalf of himself and staff, thanked the proprietors for the vote. That the half year through which they had passed—anxious one as it had been for them in some respects—had resulted so satisfactorily, was, he remarked, a source of as great satisfaction to those in the employ of the Company, as it was to the proprietors that day. He should like to personally acknowledge the cordial and friendly co-operation he had received during that time, in the absence of Mr. Helps, from all his colleagues—Mr. Caddick, Mr. Sandeman, and others—as well as the loyal support of his own chief assistants, Mr. Anderson and Mr. Haines, and all who worked with them.

Mr. A. Caddick also thanked the proprietors, on behalf of the Waddon staff and workmen, for the cordial way the Chairman's kind remarks had been received. The half year had been an eventful one; and it was only those who were engaged in the manufacture of gas who could understand the pressure that was brought to bear at times upon them. They had fortunately kept the flag flying in Croydon, and the officers and the men felt proud at having done this. That they had been able to do so was due in no small measure to the hearty co-operation that existed among the staff and workmen at Waddon. There were times when they felt the responsibility a little bit heavy, but this was assuaged a good deal by the general good feeling among the men, who were working under ideal conditions. They had been working as a happy family, in which, however, there had been one vacant place. That was the absence of their General Manager, for whom they wished a speedy recovery, and anxiously looked for his return. He wished to add one special word of thanks to the Chairman for his references to his (Mr. Caddick's) own services.

BOURNEMOUTH GAS AND WATER COMPANY.

The Coal Strike and New Gas Business—A New Vertical Retort Installation—Co-partnership.

The Half-Yearly Meeting of the Company was held last Friday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. Crispe Whiteley in the chair.

The Secretary (Mr. H. A. Plumb, F.C.A.) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

The Chairman, in moving their adoption, said he had again very much pleasure in presenting a satisfactory report, and in placing before the proprietors accounts which, he thought, would entirely meet with their approbation. The event of the past half year had undoubtedly been the coal strike. He was glad to say that the Company passed safely through it; and he thought two paragraphs in the report so concisely and correctly stated what happened that no words of his were needed to improve upon them. The paragraphs referred to said:

> The sales of gas show a substantial increase over the corresponding period of last year, due no doubt in some measure to the fact that, during the late coal strike, the public took advantage of the full supply afforded by the Company, in place of other fuel, for heating and cooking purposes.
>
> Some extra expense for coal was incurred during the dislocation of business caused by the strike. New contracts for coal have been entered into at enhanced prices, and increased cost of labour and material will have to be paid. These additional charges will, the Directors hope, be met by the continuing growth of the Company's business.

Stated shortly, the strike brought the Company more business; but it increased the cost of production. He therefore thought they might congratulate themselves that, the one about balancing the other, they passed through the crisis satisfactorily, while it might have been otherwise. The business had increased, and was continuing to increase. But, unfortunately, there was the additional cost of coal. "The evil that men do lives after them." The price of coal had gone up; and the price of every product with which they had to deal had also risen. The only way in which they proposed to meet this condition of things, and the way in which he believed they would successfully meet it, was by having a corresponding increase of business, to which they had made up their minds, and which they had no doubt of achieving. The price of coal was very high, and hardly justified, they thought, by the circumstances of the case; but it was not likely to be maintained. Though labour troubles had been elsewhere, he was glad to say they had none whatever at Bournemouth; their relations with their employees being of the most peaceful and happy character—indeed, the tone throughout was admirable. This certainly had been assisted by the co-partnership scheme which they started four years ago, and which was now most thoroughly and successfully launched. The system of profit-sharing seemed to be heartily enjoyed by the employees. Some 300 of them, as the report said, were now proprietors in the Company, and held 398 shares. The Board had placed to the credit of the scheme bonuses to the amount of £8700; and the total values held by the co-partners, either in shares or money, now reached nearly a sum of £10,000. This amount had been accumulated in four years. The Directors considered it an excellent beginning; and, there was every reason to suppose, they would go on strengthening from year to year. During the past six months, they had erected a bench of six settings of continuous working vertical retorts, under the direction and supervision of their General Manager and Engineer. The proprietors knew the peculiar interest which their friend Mr. Harold Woodall took in this modern development of gas production; and he thought they might heartily congratulate him upon the success that had attended it. The new retort-settings had been at work now for some three months, and had given every satisfaction. With regard to the future, he (the Chairman) never prophesied; but he might say they had every reason to look to the future without dismay. As he had said, in spite of the increased cost of coal, he thought they could meet this with increased business. What they had got to do was to bring home to the public the main fact (well known to themselves) that gas and the gas industry was not a worn out and effete institution, but was a live business, progressive, and capable, with fair play and a fair field and no favour, of holding its own in lighting or in any other competition that might be brought against it. Not only in private lighting could they compete; but when they came to heating with gas-fires, to gas-cookers, and gas-heated water-boilers, they had in the future room for almost unlimited development. What, however, they had to do was to let the public understand what those connected with the Company already knew. An Association had recently been formed with the object of spreading knowledge of these matters. The Company had joined the Association; and it had their heartiest and strongest support. He would like to remind the proprietors once more that, during the past twelve years, the Board had reduced the price of gas in Bournemouth by 1s., or an average of 1d. per 1000 cubic feet per annum; and since they had had the management of the affairs in Poole, they had made there an even greater reduction—from 4s. 8d. to 2s. 8d. At 2s. 6d. in Bournemouth, they were likely to stay for the present; but while there was no immediate idea of reducing the price, he thought they might promise their friends in the borough that they meant to work very hard against anything of an adverse nature that might cause them to raise the charge. He should like, before concluding his remarks, to recognize, on the part of the Board, the splendid efforts of the whole of the staff—from the General Manager downwards—to bring about these successful results half year by half year. The Board also appreciated fully the co-operation and appreciation they obtained from the consumers of Bournemouth—an appreciation which came very happily from the community that it was at once their honour and pleasure to serve.

Mr. R. H. Jones seconded the motion, which was unanimously carried.

The Chairman proposed the declaration of dividends at the rates per annum of 6 per cent. on the preference shares, 7 per cent. on the "B" ordinary shares, and 15 per cent. on the original shares.

Mr. William Cash, F.C.A., in seconding the proposition, remarked that, while the Chairman said a good deal to them about the gas business, the proprietors would not forget that the Company was a water supply one as well, and that, so long as a water company had a fair field and no favour, people would take their water supply, and the water revenue would continue to increase. Regarding the progress of the gas business, since this time last year they had had nearly 950 prepayment consumers added to their books; and this showed the extraordinary way in which the neighbourhood they served continued to progress and grow. It would be observed, from the accounts, that they were not carrying forward quite so much as they brought into the half year. But if the proprietors would look at the profit and loss account, they would see an exceptional item there: "Amount written-off on account of works displaced, £6000." Apart from this, the dividend had been more than earned.

The Chairman remarked that, with regard to Mr. Cash's comment, last year was such a hot summer that he (the Chairman) then only dealt with water. But this year he did not think it was quite so necessary; for, however good the supply of water had been that the Company had given, Nature had been assisting them in much too copious a manner during the last two months. [Laughter.]

The motion was unanimously carried.

Mr. A. W. Oke, in proposing a vote of thanks to the Chairman and Directors, remarked upon the satisfaction of the proprietors at the good provision made by the Board and the Engineer to maintain an adequate supply of gas during the strike. He had not the slightest doubt that those who came in as consumers would remain as such. As proprietors, they also viewed with interest the introduction of the vertical retorts at the Poole works; and they were pleased to hear of their satisfactory working. The reduction of 2d. per 1000 cubic feet in Poole would be welcome news to the consumers there; and if the Corporation of Bournemouth were wise, they would keep before people the fact that the price of 2s. 6d. per 1000 cubic feet of gas in the borough was an attraction to the district. He was also highly interested in the excellent report the Chairman had made regarding co-partnership; while the position of the Company was reflected in the manner that the shares were taken up which were last placed upon the market.

Mr. R. H. Glen, in seconding, said he had the pleasure of visiting the works at Bournemouth early in the year; and he should like to thank the General Manager for his kindness to him in allowing him to see a great deal of the working of the Company. After his (Mr. Glen's) visit, he was not surprised that the report was as excellent as it was. He saw the vertical retorts; and he was now glad to hear that they were working so successfully. While there he spent best part of a morning examining the various labour-saving devices in connection with the keeping of the accounts of the customers; and in this direction he believed Mr. Woodall had made quite a triumph. He could bear testimony to the admirable way in which the system was working throughout. He also saw some marvellous figures with regard to water-heaters; and so admirably was the water heating

demonstrated to him at the show-rooms at Bournemouth that, when he reached home, he ordered a heater for himself. The Chairman had referred to the good feeling that existed between the Company and the employees. In this connection, there was one thing that struck him (Mr. Glen), and that was the "suggestion-box," in which were placed written ideas for labour-saving and other improvements. Mr. Woodall showed him quite a collection of actual suggestions made by the employees, several of which had been accepted and found useful. It was quite as much on these lines as in connection with actual machinery that the Company—keeping the human machinery well oiled—were in such a successful position as now.

The proposition was cordially agreed to.

The CHAIRMAN, in acknowledging the vote on behalf of himself and his colleagues, added, on the subject of co-partnership, that the benefits were not merely a question of shares and money, but the feeling that was engendered among the workers that they were part of the Company, and that all associated with it had a common object. One of the most delightful parts of his work as Chairman was when he had the privilege of annually addressing the men. It was not quite such a serious matter as a meeting of proprietors in Cannon Street; but it was a matter of real pleasure to have before him some 400 to 500 of the officers and the men of the different departments—from Mr. Woodall down to the humblest clerk and worker, all anxious to hear what had been done during the year, and as to the prospects of the business. Before concluding, the Chairman moved a hearty vote of thanks to the General Manager, the Secretary, their staffs, and all the workers.

Mr. F. G. BARRETT seconded the motion, which was agreed to.

Mr. H. W. WOODALL, in responding, remarked that co-partnership was of the greatest possible value to any company in the time of labour disturbance. He had no doubt that they did reap the benefit of the system, although, during the whole of the time he had been in Bournemouth, he had always found the staff and men loyal, and always ready and willing to do all they could in the interests of the Company. On the other hand, both the staff and the men had every reason to be loyal, and to be satisfied, because he did not think any staff or body of men could be better treated than were those of the Bournemouth Company. He was glad indeed to hear that Mr. Glen enjoyed his visit to their works and offices.

Mr. PLUMB also responded, and the proceedings then terminated.

MITCHAM AND WIMBLEDON GAS COMPANY.

Half-Yearly Report and Accounts.

The Directors of the Mitcham and Wimbledon Gas Company report that the consumption of gas in the six months ended the 30th of June showed an increase of 10·01 per cent. in comparison with the corresponding period of 1911. The Act amalgamating the Wandsworth and Putney, the Mitcham and Wimbledon, and the Epsom and Ewell Gas Companies passed successfully through both Houses of Parliament and received the Royal Assent on the 7th inst. It comes into operation on the 1st of January next; and the Directors are confident that the result will be greatly to the benefit of both the consumers and the stockholders of all three undertakings. The advantages of co-partnership will be extended to the employees of the Company on the above-mentioned date; but it has been decided that the benefits under the scheme should date from Jan. 1, 1912. Provision has, therefore, been made for this by setting aside the sum appearing in the accounts. The Directors are pleased to report that throughout the national coal strike and the strike of transport workers, which caused so much anxiety, the Company were able to maintain an uninterrupted supply of gas.

The accounts accompanying the report show that the sale of gas produced £55,579; the rental of meters, stoves, and fittings, £10,924; and residuals, £15,033—the total revenue being £81,630. The expenditure on the manufacture of gas came to £36,383; on distribution, to £24,691; on management, to £4107; on account of co-partnership, £1200—the total expenses being £70,657. The balance carried to the net revenue account is £10,973. After providing for all charges, the sum available for distribution, including the balance brought forward, is £19,057; and the Directors recommend the declaration of the statutory dividend under the sliding-scale at the rate of 5¾ per cent. per annum, less income-tax. The portions of the accounts relating to manufacture show that, under the supervision of Mr. B. R. Green, the General Manager and Secretary, 24,314 tons of coal and 327,956 gallons of oil were used in the half year in the production of 434,977,000 cubic feet of gas, of which 412,024,800 cubic feet were sold and 418,547,800 cubic feet accounted for. The estimated quantities of residuals were: Coke, 320,000 tons; tar, 278,452 gallons; ammoniacal liquor, 699,000 gallons; sulphate of ammonia, 260 tons.

PORTSEA ISLAND GAS COMPANY.

The Half-Yearly Meeting of this Company was held at the Offices, Portsmouth, on the 10th inst.—Mr. R. E. HELLYER (the Chairman) presiding.

The SECRETARY (Mr. H. A. Stibbs) having read the notice convening the meeting, the report and accounts for the six months ended the 30th of June last were presented. The Directors stated that the sale of gas was adversely affected by the necessary restriction in the issue during the coal strike and by the mild winter. Consequently the output for the half year was slightly less than for the corresponding period of 1911; but the number of consumers and of the appliances of various kinds in use showed an appreciable increase. The labour unrest throughout the country occasioned the Directors considerable anxiety. A large additional expense was incurred in obtaining special supplies of coal during the period of the strike; but a constant and satisfactory supply of gas was maintained throughout the district. The Engineer and General Manager (Mr. J. D. Ashworth) reported that the buildings and plant at the several stations, and also the mains and meters, had been adequately maintained, and were in efficient working order. The accounts accompanying the report showed a balance on the profit and loss account of £41,196 available for distribution. This enabled the Directors to recommend the declaration of a dividend for the half year at the following rates per annum: 13 per cent. on the "A" and "B" shares, 12 per cent. on the "C" shares, 10 per cent. on the "D" and "E" shares, and 5 per cent. on the stock (all less income-tax), leaving a balance of £23,263 to be carried forward.

The CHAIRMAN, in presenting the report and accounts, expressed satisfaction at being able to meet the shareholders under less critical conditions than those which existed at the time of the half-yearly meeting in February last, when the national coal strike was feared. He explained that, in view of this contingency, the Directors had endeavoured to secure additional quantities of coal; and, though they were unable to obtain as much as they desired, it was thought by the best authorities that the six or seven weeks' supply which they then had would be sufficient to tide over any temporary cessation of deliveries. The strike had unfortunately taken place, and for no less than nine weeks the regular deliveries of coal were entirely suspended, while for some weeks afterwards partial deliveries only were obtainable. As a consequence, in order to maintain a continuous and satisfactory gas supply, it was necessary to make special purchases of coal, which had cost the Company approximately an additional £4500. This sum might have been charged to the insurance fund; but the Directors preferred to include it in the ordinary revenue charges. Notwithstanding this, the full statutory dividend had been earned, and the balance to be carried forward was slightly increased. The Chairman paid a special tribute to the energy and ability displayed by the Engineer and General Manager during the half year, which had been one of unusual anxiety. Proceeding, he pointed out that, owing to the necessity for reducing the pressure during the strike, and also to the mild winter, the quantity of gas sold in the past six months was slightly less than in the corresponding period of last year; but the number of consumers and the appliances in use showed a continuous and satisfactory increase. Less coke had been made and sold, and consequently the revenue from this source was less than before; but the receipts from tar and liquor both showed an increase. The prices of coal and oil, under the current year's contracts, were largely in excess of those of last year; but the Chairman expressed a confident hope that the present rate of dividend would nevertheless be maintained. He announced that, as a result of the coal strike, the Directors had decided to increase their carburetted water-gas plant; and a new installation, having a capacity of 2 million cubic feet per diem, was in course of construction at the Hilsea works; and he mentioned that the Standard Burner Bill, which the Company had promoted in conjunction with fourteen other undertakings, had received the Royal Assent, and would come into operation on the 1st of January next. He concluded by formally moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. F. M. Aylen) seconded the motion, and it was carried unanimously.

The usual dividends having been declared, donations of £50 to the Portsmouth, Portsea, and Gosport Hospital and £5 5s. to the Portsmouth Eye and Ear Infirmary were authorized, as was also the distribution of coke to the value of £100 among the poor resident within the Company's area of supply during the coming winter.

The meeting terminated with the usual complimentary vote of thanks to the Chairman and Directors, the officers, and the staff generally.

GRANTHAM GAS COMPANY.

Congratulating Mr. Shadbolt—Company's Increased Prosperity.

The Ordinary Half-Yearly General Meeting of the Grantham Gas Company was recently held, under the presidency of Mr. J. G. THOMPSON, the Chairman.

Mr. R. G. SHADBOLT (the Engineer, Manager, and Secretary) read the Directors' report, in which they stated that they were again able to present a very satisfactory balance-sheet, showing a sum of £4669 to the credit of the profit and loss account. Out of this they recommend that £2000 should be applied in payment of the maximum dividend of 5 per cent. per annum on the consolidated stock, and that the balance should be carried forward. In the current year, the Directors would have to provide for a substantial increase in the price of coal, and also for a considerable outlay in connection with their new holder. They were pleased to be able to report that the public had thoroughly appreciated the reduction in the price of gas made last year; the consumption of the past six months being 2,490,000 cubic feet in excess of that in the corresponding period of 1911. It constitutes a record of the highest consumption of gas for any January to June half year in the history of the Company.

The CHAIRMAN said the first thing he must do was to congratulate their Manager on the successful year he had had as President of the Institution of Gas Engineers. He had the pleasure of attending one of the various successful social functions at the close of Mr. Shadbolt's year of office, and had the opportunity of meeting and talking to various engineers of the leading gas companies of the country—notably two of the Metropolitan Companies—and the Birmingham and Glasgow Gas Corporations, and they all spoke in the highest terms both of the ability and assiduity shown by Mr. Shadbolt in the performance of his duties. They could congratulate themselves upon the fact that their Manager had attained to such an important post as President of the Institution of Gas Engineers, and at the same time had not neglected his work at Grantham. [Applause.] He thought the balance-sheet the shareholders had before them attested that he had not done so, for it was one of the most satisfactory they had ever had the pleasure of presenting. He might say it had been a somewhat anxious half year, in consequence of the coal strike, and they must thank Mr. Shadbolt for steering them well through the trying time. His foresight and ability were very considerable. The company had no pecuniary losses, and he was glad to add there was no inconvenience to the consumers or to the public. Their thanks were due to Mr. Shadbolt

for the way in which he had managed all their affairs. They would see that there was the very large balance on the revenue account of £4669; and they might perhaps naturally expect that the Directors would make some suggestion as to a further reduction in the price of gas. But they did not see their way to do this at the present juncture. If it were a normal time, possibly they might have done so; but it happened to be an abnormal time. They had to face a considerable increase in the price of coal, and to replenish their stock of coal, which was very depleted by the strike, and there would also be an exceptional outlay in connection with the large gasholder; and the Directors therefore thought the Company should await the events of the year before suggesting a further reduction in the price of gas. This would be a disappointment to the consumers, and also to their co-partners, who would suffer to the extent of the bonus that would accrue with a further reduction in the price of gas. But this was one of many things these strikes did. They seemed to affect a great number of innocent people who had nothing whatever to do with the dispute in question. He thought some means might possibly be devised by which employed and employers could meet together in a friendly manner and discuss these matters, and come to a conclusion. Although the Directors were not able to grant their co-partners anything in the way of further benefits in the reduction of the price of gas, they had been able to make them a little boon which he thought they highly appreciated. It was that every co-partner should have one week's holiday in the year at full pay. He thought this was a very good move in the right direction; and he was sure it was appreciated by the men. He concluded by moving the adoption of the report and the payment of the dividend as recommended.

The motion was carried.

TUNBRIDGE WELLS GAS COMPANY.

An Ordinary Half-Yearly General Meeting of this Company was held last Wednesday—Alderman W. H. DELVES (the Chairman) presiding—for the declaration and payment of an interim dividend. The Chairman remarked that though the half year had been an anxious one for the Directors, he was pleased that they were able to declare the usual dividend. The great coal strike, followed so closely by the strike of the transport workers, tended to interfere very seriously with their regular deliveries of coal, and naturally caused the Directors great anxiety as to their ability to continue the usual supply of gas. He was happy to say, however, that, anticipating the strike, the Directors took pains to prepare for it, with the result that when it was announced they had a large supply of coal in store, and were thus able to keep up the supply of gas throughout the whole of the period. The strike, however, had left its effects in a greatly increased price of coal; and they would have to pay an addition of something like 3s. 6d. per ton during the coming half year. The price of oil, too, had gone up; and therefore their prospects were not quite so rosy as they hoped they would be when they last met. However, they had a large balance carried forward to meet any emergency, though they hoped they would not have occasion to fall back on it. They had to look forward to an increase in expenditure this year by reason of the Insurance Act, which meant an additional outlay of something like £80 a year. He concluded by declaring the dividends as follows: 13 per cent. on the ordinary stock, 10½ per cent. on the "B" stock, and 10 per cent. on the "C" and "D" stocks. No questions were asked, and the meeting terminated with a vote of thanks to the Chairman.

HARROGATE CORPORATION AND ELECTRIC COOKING.

A Bold Assertion and a Prompt Response.

At the Meeting of the Harrogate Town Council on the 12th inst., the Electric Lighting Committee recommended that £200 should be set aside out of the past year's profits of the electricity undertaking for the development of a heating and cooking business. Alderman Chippindale moved that the recommendation be deleted; saying the time to set apart the money was when a scheme had been prepared. The department made a profit of £282 more than was estimated, but had there been a deficit, the rates would have had to find the money, and it was only right that the balance, as had always been the case, should go to the relief of the rates. With regard to heating and cooking by electricity, the Engineer would be very clever if he could make people understand that cooking by electricity could be done as cheaply as by gas. Mr. J. H. Lofthouse (the Chairman of the Electricity Department) said the Engineer had assured him that they could supply electricity at a price as cheap as any other method of cooking or heating. The amendment was lost and the recommendation adopted.

The Secretary of the British Commercial Gas Association (Mr. William M. Mason) promptly replied to the Engineer's statement in a letter which appeared in the "Yorkshire Post" last Friday. Having quoted the words attributed to the Engineer, Mr. Mason said: "A very simple statement of fact will prove the utter lack of foundation for this assertion. I understand that electricity in Harrogate is sold for cooking purposes at 1½d. per unit, and that gas is sold for the same purpose at 2s. 3¼d. per 1000 cubic feet (net). This means that 55 cubic feet of gas can be obtained at the same cost as one unit of electricity. Electricity contains 3410 B.Th.U., or standard heat units, while 55 cubic feet of Harrogate gas contain not less than 27,500 B.Th.U., or more than eight times the heating value, according to the Board of Trade method of heat measurement. No electrician can get more heat out of electricity than Nature has put into it; and I should therefore be interested in knowing how the Harrogate Electrical Engineer proposes to make good the assertion he is said to have made."

Last Thursday the streets of Tywardreath were lit with gas for the first time. The supply is from the Par Gas-Works, which now serve Par, St. Blazey, and Tywardreath.

HALIFAX CORPORATION GAS UNDERTAKING.

The Past Year's Accounts.

We have received from the Gas Engineer and Manager of the Halifax Corporation (Mr. W. B. M'Lusky) the accounts of the Gas Department for the year ended the 31st of March last, which have recently been issued from the Borough Treasurer's Department. The total revenue was £114,422, against £111,661 the year before; and the expenditure was £69,594, compared with £68,384. The gross profit amounts to £44,828, against £43,277 in the previous twelve months. After deducting interest, sinking fund, and income-tax, there remains a net profit of £17,779, which, added to the balance of £10,356 from the previous year, gives £28,136. Of this sum, £8848 is transferred in aid of rates, £3616 to the reserve fund, and £2000 to the working balance account; leaving £13,672 to be carried forward. The principal items of revenue are: Sale of gas, £80,297; meter-rents, £2380; residual products, £29,169; and prussiate of soda, £1196. On the expenditure side of the revenue account are: Manufacture, £42,597; maintenance of works, £7389; distribution, £4517; management and general expenses, £5316; prussiate of potash plant, £1001.

The portion of the accounts relating to manufacture shows that 69,942 tons of coal and 52,095 gallons of oil were used in the production of 849,416,000 cubic feet of gas, of which 796,302,700 cubic feet were sold and 8,921,500 cubic feet used on the works; the leakage being 5·14 per cent. The residuals produced were: Coke, 30,995 tons; tar, 4678 tons; and sulphate of ammonia, 785 tons. The net cost of coal was £5091, or 1·53d. per 1000 cubic feet of gas sold, against £4312, or 1·32d. per 1000 feet before. The net cost of gas at the works was 13·56d. per 1000 feet sold, compared with 13·24d.; and the total cost was 18·81d., against 18·61d. The net profit was 5·36d., compared with 4·89d. for the year 1910-11.

SALFORD GAS-COAL CONTRACTS.

The Publication of Prices.

A section of the Salford Town Council, opposed to the policy of the Gas Committee as to the acceptance of contracts for coal required at the gas-works of the Corporation and the non-publication of the figures connected therewith, are again on the "warpath," writes our Manchester Correspondent. It is a subject that has been debated in the Council frequently during recent years, and at municipal elections in the borough has been made a great deal of. A remarkable feature about the controversy, however, is that the severest critics of the policy of secrecy in regard to coal-contract prices have, when elected on the Coal-Purchasing Sub-Committee, become converts, and to-day strongly support the action of the Gas Committee.

At the July meeting of the Council, it was claimed on behalf of the Gas Committee that by contracting privately for coal and cannel a very considerable sum had been saved to the ratepayers. On that occasion, but not without protest, contracts for 84,000 tons of coal and cannel were confirmed. The matter was revived at the August meeting by Alderman Jackson, who elicited from Alderman Phillips, the Chairman of the Gas Committee, that for the contracts appearing on the *agenda* advertisements had been inserted in the papers inviting tenders. At the same time, Alderman Phillips said he was not in a position to say what the average increase or otherwise in the cost of coal and cannel was this year compared with last. What seems to have roused the opponents to the Gas Committee at present is that no figures are now available as to the prices paid for the coal and cannel purchased, not even to members of the Council. Up to last month, the custom had been for the prices to appear on the minutes of the Gas Committee; and these could be inspected by members of the Corporation, while any ratepayer in Salford had the same privilege on payment of a shilling. The prices were not given in the synopsis for the last meeting; and this has led to a sort of revolt among members of the Council. On a requisition presented to him by seventeen members of the Council, the Mayor (Alderman Linsley) has consented to a special meeting of the Council being held to-morrow, when the following resolution will be submitted:

> That this Council has learned with profound regret of the instruction given by the Gas Committee that the prices at which they have accepted offers for coal and cannel must not appear on the minutes of the Committee. Believing this to be contrary to both the spirit and the letter of the Municipal Corporation Act, 1882, and a wanton attack upon the rights and privileges of the members of the Council and ratepayers, the Town Clerk is hereby instructed to have the prices agreed upon, and future prices, inserted in the proceedings of the Gas Committee.

According to the Standing Orders of the Council, it is incumbent upon the respective Committees in cases of contracts exceeding £100 to advertise in at least one paper. Hitherto the Gas Committee have got over this by moving the suspension of the special order until the contracts have been confirmed.

MIDDLETON CORPORATION GAS UNDERTAKING.

Effect of the Increased Cost of Coal.

In moving the adoption of the minutes of the Gas Committee at the last meeting of the Middleton Town Council, Mr. A. Parker said he hoped members of the Council would be satisfied that whatever profit was being made on the undertaking was taken care of and spent properly. It would be noted from the proceedings that the Committee had decided to procure 11,500 tons of coal; and he was sorry to say that, owing to advanced prices, they would incur at least £1200 extra for coal on the current year. In face of this, it could not be expected that there would be a further reduction in the price of gas this year, as some had hoped for. The minutes were confirmed. The balance-

sheet referred to contains very little information beyond that already published in the "JOURNAL" as to the working of the undertaking during the past financial year. The net profit was £3149, compared with £3107 in the year 1910-11, and one-half of it was transferred to the reserve fund; the balance being carried forward. One fresh item is that dealing with the sulphate plant renewals account. A sum of £895 was spent under this head; and the Committee decided on the 9th of May last that the money should be charged against revenue, spread over a period of ten years, and consequently £89 10s. has this year been charged against revenue.

BURTON-UPON-TRENT GAS UNDERTAKING.

Extension of the Area of Supply.

At the Meeting of the Burton-upon-Trent Town Council last Wednesday, the recommendation of the Gas and Electricity Committee in regard to purchasing the Tutbury and Rolleston Gas-Works, to which reference was made last week (p. 467), came up for confirmation.

Alderman LOWE, the Chairman of the Committee, in moving the adoption of the report, referred to the proposed acquisition by the Corporation of the gas undertakings belonging respectively to Sir Oswald Mosley, Bart., at Rolleston, and Messrs. J. C. Staton and Co., at Tutbury. It was, he said, most desirable to increase the output of the works; and therefore the Committee had been looking about in every way to encourage the use of gas. They had supplied stoves without rent, and purchased the Barton Gas-Works. The result of the latter was that in the first six months they had an increase from Barton of 17 per cent. They were also getting on extremely well at Stretton, and in a short time he hoped to say they were supplying 75 per cent. of the houses. They had for some time been negotiating with Mr. Henry Newton for the Tutbury Gas-Works, and Sir Oswald Mosley, Bart., for the Rolleston works, and they now recommended that this should be done at a cost of £3000 for the Tutbury and £1500 for the Rolleston works. The total cost of the scheme would be £11,500, which would include the plant but not the land. They would also have to instal a booster plant, the cost of which was included. An important point was the charge for gas in these places. In a short time they hoped to reduce the price in Burton to 2s. per 1000 cubic feet, and at Tutbury they proposed to charge 3s., or 1s. more than in Burton. In Rolleston it was proposed to charge 3s. 6d., instead of 5s. 5d.; so that this reduction would be a considerable stimulus. The Local Government Board would not grant the necessary Order unless the Council could show that it would be an advantage to the Corporation and the ratepayers to acquire these undertakings, also unless it would be to the advantage of the inhabitants of the districts. Tutbury was now being charged 3s. 6d. per 1000 cubic feet, which was a reduction from 5s. 6d. last January.

Mr. TARVER seconded the motion; and the report was adopted.

Subsequently, Alderman LOWE moved the formal resolution to apply to the Local Government Board for a Provisional Order authorizing the Council to acquire the Tutbury and Rolleston Gas-Works; and it was adopted.

GAS CHARGES AT ROCHDALE.

Comparison with Other Towns.

In accordance with instructions from the Gas Committee of the Rochdale Corporation, Mr. T. Banbury Ball, the Gas Engineer, has prepared a return showing the charges for gas in other towns, together with particulars as to the arrangements in force in these respective places in supplying and fixing stoves and meters. The information, which has been compiled in view of the application on the part of the Rochdale Trades Council that the price of gas should be reduced to consumers in the borough, was submitted to members of the Gas Committee at their meeting last Wednesday. A final decision on the question of price was, however, deferred until the next meeting of the Committee. At present, the price of gas in Rochdale is 2s. 6d. per 1000 cubic feet; and the discounts vary from 2d. per 1000 cubic feet to users of up to 10,000 cubic feet, 3d. to those consuming up to 50,000 cubic feet, up to 100,000 cubic feet the discount is 4d., and over 100,000 feet there is a rebate of 5d. per 1000 cubic feet. For purposes other than lighting, the prices are 2s. per 1000 cubic feet up to 10,000 feet, 1s. 9d. up to 100,000 feet, and 1s. 6d. over this quantity.

Information has been obtained from 34 towns in Lancashire, Yorkshire, and Cheshire, also from Derby and Leicester. The returns show that in the case of 22 out of the 36 towns, the price of gas for lighting is less than at Rochdale; but as regards the charges for other purposes, Rochdale holds a favourable position in comparison. Sixteen of the authorities charge meter-rents, and twenty do not. In three of the towns—namely, Oldham, Heywood, and Bradford—the meters belong to the property owners. Twenty-four authorities fix meters free of charge. In some of the other towns, the property owners both provide and fix. Manchester, it is pointed out, supplies meters free, but does not fix them; while Derby fixes free, including 15 feet of service pipe on private property. Some authorities confine free fitting to slot meters; and in one or two cases the practice of fitting the ordinary meters is confined to those which are hired. Generally speaking, the charges made merely represent cost of material and time.

As to gas-cookers, it is shown that twenty of the authorities let these out on hire, and that the number who supply them free is small. In many cases, the stoves are let out on hire-purchase—three years being the general purchase period. It is mentioned that in Leeds small cookers are supplied without charge to slot-meter consumers; but the gas for them is 2s. 8d. per 1000 cubic feet, or 6d. more than is charged for lighting. Warrington is cited as granting the free use of cookers to slot-meter consumers of 8000 cubic feet and over per annum. Where the cookers are on hire, the charges vary considerably. In the main, however, they range from 5 to 10 and 12½ per cent. on the cost. At Liverpool, the fee represents a return of the cost of installation at the end of ten years; at Salford, the summer charge is double that imposed in winter; at Warrington, the rents are so fixed as to get back the cost, *plus* 42½ per cent., in twelve years; and in the case of Bury, the arrangement is 10 per cent. on the cost for three years and 5 per cent. afterwards. Eighteen of the corporations making a return fix the cookers free of charge, others do so only in the case of slot meters; some charge half the cost; and others call on the householder to pay for materials. The interesting fact is added that "almost without exception the authorities who fix employ their own gas-fitters."

One of the questions put by Rochdale was: "Have you a separate fitting department undertaking ordinary gas-fitting work?" Seven replied in the affirmative. Manchester has such a section "for inspection only;" Wigan does such work, "but not in competition with ratepayers;" at Bradford, it is done to a limited extent; and in Bury there are central workshops away from the gas-works from which all distributive work is done. In the great majority of the 36 towns, there are separate show-rooms in connection with the gas-stove or fitting department. Those who make separate provision are Accrington, Blackburn, Bradford, Birkenhead, Bolton, Bury, Chorley, Derby, Halifax, Huddersfield, Lancaster, Leeds, Liverpool, Preston, Radcliffe, Rossendale, Salford, Southport, Stockport, and Warrington. In six other towns, the show-rooms are at the gas-works. The report from Oldham states that central provision of the kind is under consideration by the Gas Committee.

From the tabulated statement accompanying the report the following are the towns where gas for lighting is cheaper than at Rochdale.

Town.	Price per 1000 Cubic Feet. s.	d.	
Ashton	2	4	
Blackpool	2	2	
Bradford	2	1	with 5 to 12½ per cent. discount.
Birkenhead	2	3	
Bolton	2	4	
Burnley	2	1	less 5 per cent.
Bury	1	11	
Derby	2	0	to 2s. 4d.
Halifax	1	10	to 2s.
Huddersfield	2	0	less 5 per cent.
Lancaster	2	1	,, 2d. discount.
Leeds	2	2	,, 5 per cent.
Leicester	2	4	
Liverpool	2	1	
Manchester	2	3	(including cooking and heating)
Nelson	2	3	
Oldham	2	1½	to 2s. 5d., with 6d. discount.
Salford	2	3	,, 2s. 7d., ,, 4d. ,,
St. Helens	2	0	After Sept., dis. 5 to 12½ per cent.
Wallasey	2	0	
Warrington	1	11	to 2s. 1d.
Widnes	1	1	to 11d.

The places where the charges are above those at Rochdale include: Accrington, 2s. 10d. to 2s. 7d.; Barrow, 2s. 6d.; Blackburn, 2s. 9d. less 5 per cent.; Chester, 2s. 8d., discount 1d. to 6d.; Chorley, under 200,000 feet 2s. 8d., over 200,000 feet 2s. 5d.; Heywood, 2s. 9d.; Middleton, 2s. 10d. to 3s. 2d.; Preston, 3s. 2d. less 15 and 20 per cent. discount; Radcliffe, 2s. 7d. to 2s. 9d.; Rossendale, 2s. 10d. to 2s. 11d., less 2½ per cent.; Southport, 2s. 8d., less 5 per cent.; Stockport, 2s. 6d., less 2d. discount; Todmorden, 2s. 6d., less 12½ per cent.; Wigan, 2s. 10d., less 10 to 20 per cent. discount. At Accrington, the ordinary discount is 2½d. per 1000 cubic feet. Consumers of less than 70,000 cubic feet pay 2s. 10d., and over 70,000 feet the charge is reduced to 2s. 7d. Wigan grants 10 per cent. discount to consumers up to 150,000 cubic feet; over this quantity, the discount is 20 per cent. Nelson power consumers of 125,000 cubic feet a quarter get gas at 2s., over 125,000 and up to 250,000 cubic feet the charge is 1s. 9d., and above this quantity 1s. 6d.

ROAD TARRING FOR DUST PREVENTION.

Work of the Kent County Council.

In the course of an article on "Road Improvement" in the "Daily Telegraph" last Thursday, the writer, after dealing with the experimental stage of the use of tar on roads for the mitigation of the dust nuisance, made the following remarks.

Though the tar mixtures now employed may not be all that could be desired, they have enormously improved the surface of roadways. Where the treatment is effectively done, the road crusts are smooth and free from dust. It is recognized, however, that in many cases much more drastic treatment must be adopted. Doctoring the crust is not of much avail if the road has never been properly constructed; and there is a movement afoot for the use of higher-grade road materials. Efforts are being made to demonstrate that a good quality of hard stone, well laid with a suitable bituminous binder, though costing more at the outset, will actually result in a saving, owing to its greater length of life and less cost for maintenance. Hitherto local stone has been generally used, even though it was soft and unsatisfactory; but an attempt is being made to persuade local authorities that it is to their interest to import better materials.

Up to the present, the tar painting and tar treatment of roads have been mostly carried out in the South of England. In fact, if a line were drawn east and west through Warwickshire, it would be found that about 95 per cent. of the tar treating was on the roads on the southern side. The practice is, however, spreading rapidly, more especially since local authorities have been encouraged by grants from the Road Board. In this movement the county of Kent has possibly done more than any other county. Last year 596 miles of road were treated in Kent, at a cost of nearly £34,000. This enormous expenditure is required because of the great amount of motor traffic in the county. From a census that has been taken, it appears that motor-

cars and other self-propelled vehicles account for no less than 75 per cent. of the traffic on the main roads.

The cost of treating roads with tar or similar substances varies considerably; but on an average it may be placed at from 2d. to 3d. per square yard. A coating will not last for more than one season; and if the traffic is very heavy, the process may have to be done more than once a year. It will thus be seen that the expense is heavy and continuous. It is absolutely necessary, however; and if the ratepayer is not quite compensated by the extra longevity of the surface of the roadway, he has the satisfaction of having seen the dust nuisance practically removed. The ratepayer is also finding relief from the grants received by local authorities from the Road Board. The case of Kent was mentioned above, and it may be well to state that the Road Board announced early in July that it had made a grant of £15,525 to the Kent County Council for the improvement of road crusts. The great expense of tarring in Kent has consequently not fallen wholly on the ratepayers. In addition, the County Council received £4475 from the Road Improvement Fund for widening and diverting roads and reconstructing bridges. Up to June 30 last, the Road Board had made advances for the improvement of road crusts amounting to £525,980. Upwards of £100,000 had also been given for other improvements, while further advances, amounting to about £594,000, had been indicated to highway authorities towards works of improvement of which the details were still under consideration.

It may be of interest to add a few particulars from the eighth annual report of the Kent County Surveyor (Mr. H. P. Maybury, M.Inst.C.E.), a copy of which we have just received from him. He has 596 miles of roads under his supervision—576 miles being in rural and 20 miles in urban districts; and the actual cost of maintenance, tar-painting, and improvement work carried out during the year ended the 31st of March last (omitting shillings and pence) was £112,361—being £18,117 more than in the preceding year. Of this amount, £36,205 was expended upon tar-painting, widenings, kerbing, channelling, paving, and drainage works, representing £60·6 per mile. The cost of maintenance proper, therefore, is £127·6 per mile; being £14·8 per mile more than before. The tar-painting bill alone came to £28,665; 1,146,634 gallons of tar having been used, the payments for which represented £12,583. The area treated was nearly 6 million superficial yards. In addition to these large purchases of tar, Mr. Maybury procured and used some 400 tons of pitch and bitumen, at a cost of about £900. In the urban retaining districts, the Council actually paid to the several authorities £5103 for tar-painting about 125 miles of road, representing 1,530,094 superficial yards. Tar-painting, therefore, carried out in the county in the year under review, represented no less than £33,769.

THE CENTENARY OF GAS LIGHTING.

Progress of Gas Supply in Manchester.

In a recent number of the "Manchester Guardian," an article appeared in which the writer surveyed the progress of gas supply in the city during the past hundred years. After reference to the early days of gas lighting in London, he proceeded with his subject as follows.

It is rather more than a hundred years since streets and houses in Manchester were first lighted with gas. So early as 1804 or 1805 (the exact month is not recorded), the mills of Messrs. Phillips and Lee, in Chapel Street, Salford, were lighted with gas. These mills were then the largest cotton mills in England, and the fame of the new illuminant was sounded far and wide. At that time, Manchester and Salford were locally under the control of one body, called the Commissioners of Police; and to them belongs the honour of being the first towns in which "the regular and complete application of gas for economical purposes was successfully tested." It is interesting to note that the lighting of the Salford mills was done under the personal superintendence of Mr. Murdoch, the discoverer and introducer of gas as a source of lighting. It was estimated that the average daily consumption was 2500 cubic feet, requiring 110 tons of cannel, at a cost of £125. In addition to this, about 40 tons of common coal for fuel were needed, involving a further outlay of £20. Deducting the value of the coke produced (£93), the annual net expenditure was £52. The interest on the capital outlay was estimated at £550, making a gross total annual expenditure of about £600. How welcome the new illuminant was may be inferred from the fact that the corresponding cost of candles and oil at the mills was £2000. This was the beginning of gas lighting in Salford. It was the result of private enterprise.

How did the experiment, as it was then, fare in Manchester? The Commissioners of Police first put up a lamp over the door of the then Police Office. Mr. Shuttleworth, who was at one time Chairman of the Gas Committee of the Corporation, in a paper read by him at the Manchester meeting of the British Association in 1861, said: "I well remember the sensation which this lamp produced, and the crowds that, night after night, gathered in front to gaze at it; manifesting by their eager and intense curiosity a vague sort of impression that an element of interest was being developed that would be useful to mankind." The experiment was soon extended to the lighting of the entire premises occupied by the Commissioners; and this soon led to the use of gas for the lighting of streets in the "most frequented parts of the town."

As the use of gas spread, the Commissioners hit upon the idea of setting up a municipal trading concern; and on April 30, 1817, they called a public meeting, whereat it was resolved unanimously—"That it will be expedient to adopt the proposed mode of lighting the central parts of the town with gas, and for the purpose of effecting this object to raise the police rate from 15d. to 18d. in the pound." It follows that the year 1817 may be regarded as that from which the public gas undertaking of Manchester can date. In that year, the Commissioners purchased a plot of land adjoining the then police and town's yard, and proceeded to erect gas-works upon it; and when these were completed, they dispensed gas at 14s. per 1000 cubic feet.

In 1824, the Manchester Gas Act was passed; and it was the first legislative recognition of the principle that gas-producing establishments might be created by public funds, and be conducted by public bodies for the public benefit. Thirty Commissioners were appointed as Directors. They set to work, and in due time the works in Rochdale Road appeared. In 1828, an Act was passed separating the Salford Commission from that of Manchester. The year 1833 was a critical one as regards municipally-owned gas-works. There were people who held that the Commissioners had gone beyond their rightful province, and a movement (which, happily, came to nought) was started for the purpose of selling the works to a private company.

How great the contrast between Manchester's gas undertaking in those early years of the Nineteenth Century and in the present year is shown by Mr. F. A. Price, the Superintendent of the Gas Department of the Corporation. "On the 24th of June, 1843," Mr. Price states, "the powers and duties of the Commissioners were transferred to the Corporation; and from that date the gas-works became municipal property. Borrowing powers amounting in the aggregate to £2,700,640 have been obtained by the Corporation in respect of their gas undertaking; and at the 31st of March last these powers had been exercised to the extent of £2,636,342. Since the works became the property of the Corporation, the sum of £1,683,113 has been placed to the sinking fund out of the revenue of the department for the repayment of debt, and £752,807 written off the value of the plant as depreciation. During the same period, net profits amounting in the aggregate to £3,065,084 have been applied to the purposes of the Improvement, Water-Works, and Finance Committees respectively. The financial position of the department, as disclosed by the last balance-sheet, was—

Total value of works, property, and other assets . .	£3,238,061
Total liabilities (including the mortgage debt, £1,118,681)	1,231,003
Excess of assets	£2,007,058

The price charged for gas in 1817 was 14s. per 1000 cubic feet, and at the time the undertaking was transferred to the Corporation the price was 6s. The present prices are: For the ordinary consumer in the city, 2s. 3d. per 1000 cubic feet, and 2s. 6d. if he lives outside the city area. For motive power, the charges are 1s. 9d. and 2s. The output of gas in 1844 was 248 million cubic feet; and in the year ended March 31, 1912, it reached 5687 millions—showing an average increase of 4·82 per cent. The total number of consumers at the date just named was 183,793."

The total quantity of coal, cannel, and oil used in 1912 was 496,918 tons; yielding 5,693,190,000 cubic feet of gas (equal to 11,457 cubic feet per ton), of an average illuminating power of 17·13 candles. The percentage of coal used was 80·76, of cannel 1·06, and of oil 18·18. The total revenue of the department from all sources last year was £805,254. There are laid in Manchester streets 958 miles of mains, varying in diameter from 36 to 2 inches. The quantity of gas sent out last year (1911) and accounted for was 96·78 per cent. of the total output; the loss by leakage and condensation being, therefore, only 3·22 per cent. There are 117,640 ordinary and 66,153 automatic meters in use; making a total of 183,793. Of this total, 183,456, or 99·82 per cent., are the property of the Corporation. The Gas Committee commenced to hire-out meters in 1861, and the charge for hire was abolished within the city from March 31, 1895, and beyond the city from Sept. 30, 1898. Prepayment meters were introduced in 1891. The number of stoves in use on March 31, 1912, was 58,799, and of fires 2319.

Mr. Price thus summed up the position: Total manufacturing capacity of all the works in 24 hours—coal gas 23 million cubic feet, carburetted water gas 8 millions, total 31 millions; total storage capacity of all the gasholders, 34,770,000 cubic feet; largest consumption of gas in 24 hours, 28,810,000 cubic feet; total quantity of gas manufactured during the year ended March 31, 1912, 5,693,190,000 cubic feet; total quantity of coal, cannel, and oil used to produce this, 496,918 tons; largest quantity of coal, cannel, and oil carbonized in 24 hours, 2153 tons; total number of employees, including administration staff, at March 31, 1912, 1972.

WOMEN INSPECTORS OF GAS-STOVES.

Successful Experiment by the Oldham Corporation.

The appointment some time ago of two women inspectors of gas-stoves by the Gas Committee of the Oldham Corporation has turned out so satisfactorily that an additional inspector is to be engaged. In the case of the first two, the salary was fixed at 36s. weekly for the senior and 24s. weekly for the other. The matter came before the Gas Committee at last Wednesday's meeting, when Mr. Arthur Andrew, the General Manager, recommended that, in view of the proposed utilization of the services of a trained inspector in giving demonstrations in the show-room, a third woman inspector should be appointed at a salary not to exceed 30s. per week. Mr. Andrew added, in answer to questions, that experience had shown the value of these inspectors. Where people did not know how to use the oven part of a gas-stove, they were shown the way to get the best results. If consumers had no intention of cooking below the stove surface, they were advised to substitute the stove for a griller; and it was a fact that people, as the result of the work of the inspectors, were keeping their stoves in better order than before. All this meant a considerable gain to the Corporation. Answering a question, the Chairman said the amount of work involved in the inspection was considerable. This would be gathered from the fact that the inspectors would be four years in getting once round the supply area. In the end, the Committee adopted Mr. Andrew's suggestion; and, as stated, a third inspector will be engaged as soon as possible.

Barry Water Supply.—After a long discussion on Monday last week, the Barry Urban District Council decided to promote a Bill to sanction the carrying-out of a scheme of water supply. It was explained that though the scheme was estimated to cost £130,000, which would mean an increase of between 1s. 10d. and 2s. in the pound in the local rates, it would be a boon to Barry.

METROPOLIS WATER SUPPLY.

Proposal for Gravitation Reservoirs.

In the course of a long letter recently addressed to "The Times," Mr. Thomas Hennell, M.Inst.C.E., discussed the subject of the construction of gravitation reservoirs in the valley of the Loddon. He pointed out that when the whole question of the provision of additional storage of water for the supply of London was gone into by the Llandaff Commission some years ago, they reported that no site had been suggested to them where the water of the Thames when it is in flood or high could be taken into storage reservoirs by gravitation and without pumping. If such a site could be found, free from serious obligations as to supplying compensation water, they said it would present a double advantage—viz., "The cost of pumping to store would be saved, and it would be possible to take much more water into the reservoirs when the river is full, as the intake would not be limited by the capacity of the pumps, which cannot deal with more than a fraction of the water passing down in times of flood." They added that "the problem of keeping up the supply of water without interfering with the river when it is low would be materially simplified by such a gravitation intake." Bearing upon these remarks, Mr. Hennell offers the following observations.

The valley of the Thames itself below Oxford is not suited for the construction of gravitation reservoirs. But it is different with the tributary rivers, whereof two only—the Loddon and the Kennet, not far apart—bring down together a volume of water forming nearly one-fourth of the whole at that point. The Loddon alone would furnish a storage of 9000 million gallons, even in the driest seasons, and generally much more. The present storage capacity of the Board's reservoirs for Thames water is less than 8000 millions; and they are only at present proposing to provide 7000 millions more. The impounding of the water of this one tributary would therefore provide for increases during a long period.

The water of the Loddon can be intercepted about nine miles above its junction with the Thames, and made to flow into a reservoir which will occupy the valley for a length of four miles. The soil throughout is London clay almost close to the surface, and absolutely retentive of water. No main road, navigation, or railway would be affected by this reservoir, and the interference with local roads would be very trifling. Nor could the obligation as to compensation referred to by the Commissioners be at all serious in this case.

A volume of 3250 million gallons could be impounded in this reservoir. The water would then be conveyed in an open channel across nearly level ground to Fifield, near Bray, by steel pipes under the Thames, and by another open channel to the site near Staines, where works for filtration and pumping to the North of London are now arranged for. On the line of this channel at Fifield there is a favourable site for other reservoirs, also to be filled by gravitation, which would bring the total storage up to 9000 millions. This site is also entirely on clay; and practically no roads or property other than agricultural land would be interfered with.

The cost of the works would not, it is believed, be at all greater—in all probability less—than those necessary for impounding a similar volume by any other means. No banks would be required round a great part of the reservoirs, which would be looked down upon from the neighbouring higher ground. There would be no deep puddle trenches, and no pumping machinery. As against this, there would be perhaps 15 additional miles of channel.

The water impounded would be that of the rivers Loddon, Whitewater, and Lyde, all having their sources in springs which issue from a large area of exposed chalk. If the Blackwater, on the east side of the valley, be excluded, as it probably would be, there is hardly a purer water in any part of the Thames basin. The area drawn from is entirely above flood level, and there would never be any admixture of objectionable flood water, as must be the case in the Lower Thames during a great part of every year. And, while no water should be taken when the river is low, on the other hand the entire flow of the Loddon would be intercepted whenever there are floods lower down; and the Thames would be relieved to this extent all the way from Wargrave to Teddington.

It should be observed that the relief afforded would not be limited to the volume which the reservoirs are designed to contain. This represents the total quantity which would be impounded in an unusually dry year. Otherwise, after the close of each dry season, all the water would be taken into the nearer reservoir, and passed on as convenient to the others, and then for consumption in the district. When the quantity is considerable, it could be used in preference to other water requiring to be pumped. Also, in the event of serious floods not too late in the season, some water could always, after a flood has ceased, be discharged back to the rivers. Hereafter, if the Kennet and other tributaries can be similarly dealt with, the relief would, of course, be greatly increased.

SHEFFIELD CORPORATION WATER UNDERTAKING.

The Past Year's Working.

The annual report and financial statement in connection with the water undertaking of the Sheffield Corporation has just been issued by Mr. William Terrey, the General Manager, who has forwarded us a copy. It furnishes the following particulars.

The total income from all sources in the year ended the 25th of March last was £190,370—being an increase of £12,259 on the preceding year; and the total expenditure amounted to £45,755, or £4164 more than before. The gross profit totalled £144,615 (or £8094 more than the previous year), on which there were charges amounting to £120,489. This left a net profit of £24,126—an increase of £262. Deducting £14,156 set aside for the redemption of annuities and the extinction of loan indebtedness, the surplus for the year was £9969. This is carried forward to the next account, towards meeting the first full year's statutory charges on the Derwent works, which become payable next year. The increase in gross income is the largest since the transfer of the undertaking in 1887. The total capital expenditure has been £3,588,692, and the accumulated surplus on March 25 was £145,452. The charges on the Derwent Valley works included in the accounts are based on the Board's precepts, and have been paid without prejudice to the position of the Corporation, in view of the reference to the standing arbitrator of the settlement of the legal apportionment between the four Corporations concerned.

The total population supplied on March 25 was 701,141; the number of houses, 113,171; of baths, 18,736; and the total domestic and trade supplies was 217,868—an increase of 4660. The average rate per head per day for domestic and all other supplies not by meter was 13·10 gallons; and the total average daily supply for all purposes was 29,539,122 gallons. The total for the year amounted to 10,811,318,782 gallons, compared with 10,434,135,519 gallons in 1910-11. The total length of mains is now 578 miles; the length of new mains laid during the year reaching 5 miles 880 yards.

The prolonged drought, which continued from March last year until the first week in October, and the consequent large increase in the use of water for domestic and trade purposes, severely taxed the resources of the undertaking. The rainfall in the six summer months of 1911 was 7·076 inches below the average of the same months of the last forty years; while the average for the year was only 2·239 inches less than the average over that period. The average daily supply reached a maximum of 18,085,021 gallons during the week ended the 15th of July, compared with the average daily supply for the year of 15,928,677 gallons. The supply to the city and district was furnished throughout the year without restriction or limitation; and the unbroken record of "constant supply" since the year 1870 was maintained. The severe frost at the end of January and the beginning of February this year caused an exceptional number of bursts and leakages in consumers' communication-pipes and fittings, resulting in a large increase in the daily supply, which reached a maximum, during the week ended the 10th of February, of 17,724,425 gallons per day, or 11·27 per cent. in excess of the average for the year.

On the 6th of July, the Water Committee accepted a tender for the erection of a battery of 32 pressure filters at Low Bradfield. Contracts have since been entered into for the construction of a filter-house. It is anticipated that the plant will be ready for use during the autumn, and when these filters are in operation the whole of the water supplied to the city and district will be filtered.

In moving the adoption of the minutes of the Water Committee at the meeting of the City Council last Wednesday, Alderman Styring said the accounts for the past year showed that the accumulated sinking fund of the Water Department was now £309,015; and Mr. Terrey had told him that if this were allowed to accumulate for the statutory sinking fund period, it would produce £1,842,825. The total cost of the original works was £2,092,200. Therefore, if they added to the fund the accumulated surplus of £160,510, it showed they had reached the point where they had paid out of revenue the entire cost of the undertaking as they originally purchased it. The increase in the revenue for the past year had been £12,259; and the average increase for the past two years £9739. The increased expenditure was £4164. This appeared rather a large item, but it was easily explained, as it included £930 for increased rates and taxes, largely in respect of the filter-beds at Langsett; £1378 written off for low-pressure meters; and £806 contributed to the Derwent Valley Water Board expenses. Their contributions to these had now begun; but what the annual charge would be, they did not know at present. It would be somewhere between £23,000 and £32,000. The department was in the fortunate position of being able to meet all liabilities that might come against it as a partner in the Derwent undertaking. They had had an exceedingly prosperous year; but one question which should be borne in mind was that if their revenue was rapidly increasing, so were their resources and capacity of supply being overtaken and depleted. There was no doubt whatever that at a very early date they would have to ask the Council to take into consideration some scheme for providing additional resources.

MANCHESTER WATER SUPPLY.

Third Pipe from Thirlmere Nearing Completion.

According to a report laid before the Water Committee of the Manchester Corporation, considerable progress has been made in the laying of the third pipe from Thirlmere to the reservoir at Audenshaw, on the borders of the city. The estimated cost of putting down this pipe is about a million sterling; and some idea of the immense amount of work entailed by bringing the pipe round the south side of Manchester may be formed from the fact that eleven railway lines and four canals had to be crossed on the way. Not the least uninteresting of these is the tunnel under the Ship Canal. In order that the development of the Company's land might not be interfered with, the tunnel was made about 600 feet long between the shafts. Both tunnel and shafts are lined with cast-iron plates, having an inside diameter of 14 ft. 6 in.; with plates 1⅛ inches thick. The least distance between the tunnel arch and the bed of the canal is about 25 feet. Water-pipes have still to be laid through the tunnel, and the valve-houses erected at the shafts. Three pipes, each 40 inches in diameter, are to be put in; and at all the fifteen crossings mentioned similar provision has been made in anticipation of the fourth and fifth pipes from Thirlmere, which, at the rate Manchester is using water, will be required in ten and twenty years. Messrs. G. H. Hill and Sons, of Manchester, are the Engineers.

Cooking with Natural Gas.—Much natural gas has been used in parts of this district, says the British Consul at St. Louis (U.S.A.), for manufacturing and domestic purposes; but in most parts the supply has already failed, while in others the pressure has diminished so that in cold weather the consumers who have no other methods of warming their houses and cooking have suffered severely, as the houses were not adapted to any other method of heating, and the supply of gas was not sufficient for cooking.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Aberdeen.—The Lighting and Fires Committee of the Aberdeen Town Council, at their meeting on Wednesday, had under consideration the motion moved by Councillor Sangster at the last meeting of the Town Council in connection with the lighting of King Street by high-pressure gas. After deliberation, the Committee recommended that the Gas Engineer, the Electrical Engineer, and the Lighting Inspector should draw up a report, giving the capital cost of the annual upkeep of lighting by gas and electricity.

Arbroath.—The report of the operations of the Arbroath Corporation gas undertaking for the year ending May 15, which was submitted to the Town Council on Monday, shows that the cookers, grillers, and rings now fixed number 4747—an increase of 271 over last year. During the year, 84 gas-fires have been installed. These fires have all been sold outright, except two, which are on the hire-purchase system. Coal and benzol cost 12s. 4½d. per ton at the works; and the net sum received for residuals was £4085, equal to 7s. 7½d. per ton of coal used. Coal will cost fully 2s. per ton more next year; and it is estimated that residuals will yield about 9d. more per ton of coal used. The balance at the credit of the profit and loss account is (subject to audit) £5028. After deducting the sums payable for interest, &c., there remains a profit balance of £2175. The Gas Committee agreed that this amount should be utilized in wiping-off the balance standing at the debit of the suspense account, which leaves £192 to be carried forward to next year's account. The Committee had under consideration the exceptional results derived from the year's working, and the increased price received from tar, sulphate of ammonia, and coke, and the disuse of benzol; all being likely to enable matters to go on for another year without increasing the price of gas, notwithstanding that the enhanced price of coal was equivalent to more than 2½d. per 1000 cubic feet of gas. The Manager reported that, after consulting with the Convener, he was of opinion that the price of gas could safely be reduced 1d. per 1000 cubic feet. The Committee unanimously agreed to recommend to the Council that the reduction proposed by the Manager should be adopted, and that the prices of gas for the current year be made as follows: Ordinary consumers, 2s. 5d per 1000 cubic feet; prepayment meter consumers, 2s. 10d. per 1000 cubic feet; engines, 2s. to 2s. 2½d. per 1000 cubic feet, with discounts as arranged for large quantities, but under the modification that consumers, with a view to getting the benefit of the discounts, shall not be allowed to add the quantity of gas consumed in their private dwelling-house to that used in their business premises. The report was approved of.

Brechin.—The proprietors of the Brechin Gas-Works have refused to sell their works to the Town Council for £30,000. It is intimated that they are willing to confer with the Council on the matter.

Buckie.—At a special meeting of the Buckie Town Council held on Monday night—Provost Archibald in the chair—the Secretary of the Gas Company announced that the price of gas for street lighting would be increased by 2½d.—making it 5s. 10d. per 1000 cubic feet—on account of the rise in the price of coal. The Council will be allowed 5 per cent. discount for cash.

Dundee.—There is to be an extension of the use of automatic controllers for the street-lamps of Dundee. At a meeting of the Police and Lighting Committee of the Town Council on Tuesday, the Gas Manager reported that during the past year the lamps of the Barrack Park and of many of the important streets in the centre of the city had been operated by clockwork controllers, and had proved both satisfactory and economical. With 1000 controllers in use, the saving effected in gas alone represented £190; and he recommended the introduction of an additional 2000 controllers, which, together with those already in use, would effect an annual saving on the gas consumption equal to £570. The controllers cost from 23s. to 26s. each. The proposal was agreed to.

Helensburgh.—The price of gas in Helensburgh is to be reduced to 2s. 6d. per 1000 feet after the next survey. The rate is now 2s. 11d.

Monifieth.—At a meeting of the Town Council held on Tuesday night, Councillor J. Maxwell Rattray, the Convener of the Finance Committee, stated that the financial condition of the town's gas undertaking would allow of a reduction in the price of gas of 3d. per 1000 cubic feet—that is, from 4s. 3d. to 4s. Taking into account the 5 per cent. allowed on payment, this brings the net price to 3s. 9½d.

Penicuik.—The annual general meeting of the Penicuik and District Gas Company, Limited, was recently held in Edinburgh. Ex-Provost Wilson, who presided, stated that the shareholders had reason to congratulate themselves on the satisfactory result of the year's operations. The report and statement of accounts were adopted, and a dividend of 9 per cent. was declared on the ordinary shares; leaving a balance of £379 to be carried forward. The Chairman intimated that the Directors had decided to reduce the price of gas by 2½d. per 1000 cubic feet as from the 1st of July last.

Reduction in Price in Bromley and Crays.—The Directors of the South Suburban Gas Company have announced that, under the provisions of their Act of the present session, the price of gas is reduced in Bromley from 3s. to 2s. 10d., and in Crays from 3s. 6d. to 3s. 1d., per 1000 cubic feet.

Melton Mowbray Gas Company.—At the recent annual meeting of this Company, the report presented showed that a much larger business had been done in the past financial year, and had resulted in a profit of £2342—an advance of £242 on the previous year. The Chairman (Mr. J. Glover) moved the adoption of the report, and also the declaration of a dividend of 7½ per cent. for the year; and this was carried. After some expressions of satisfaction at the year's work, votes of thanks were passed to the Chairman and officers (including the Manager, Mr. G. R. Casterton), and the meeting closed.

THE "MAIN"

GAS WATER HEATERS.

Among the many different types of Water Heaters now upon the market, those bearing the name "MAIN" excel.

Next to their efficiency they possess qualities which are most important to Gas Companies who let out this form of apparatus on hire, viz.:—Strength and Simplicity.

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CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 17.

During the past week there has been a more active demand in all positions, and values have steadily increased. The inquiry from direct buyers has, however, not been very extensive, and the purchasing has been principally for account of middlemen. The market closes with a further upward tendency at £14 7s. 6d. per ton f.o.b. Hull, £14 8s. 9d. per ton f.o.b. Liverpool, and £14 10s. per ton f.o.b. Leith, for early shipment. In sympathy with near delivery, there has also been an improvement for the later periods, and it is reported that £14 10s. per ton f.o.b. Liverpool has been paid for October-March, and £14 12s. 6d. per ton f.o.b. Leith for January-June, in equal monthly quantities. Makers are now asking 2s. 6d. per ton more money; but no business has transpired at the advance.

Nitrate of Soda.

The tone of this market is again firmer, and the prices on spot now are 11s. 4½d. and 11s. 6d. per cwt. for ordinary and refined quality.

LONDON, *Aug.* 19.

Tar Products.

Tar products have been steady throughout the past week, and prices have been well maintained. There is little business doing; buyers preferring to wait. Pitch is steady. Buyers are still holding off except in South Wales, where there is a good demand for both prompt and forward. Benzols are very firm indeed; 1s. 0½d. prompt and 1s. all next year being about the prices. Fifty-ninety's are quiet. Most makers find it better not to make this quality at present. There is rather more inquiry for toluol for prompt delivery. Carbolic is still firm, with dealers offering more than can be obtained from actual consumers. Creosote continues firm; but a large sale is reported to have been made in London recently at a reasonable price.

The average values during the week were: Tar, 29s. 6d. to 33s. 6d. *ex* works. Pitch, London, 51s. to 52s.; east coast, 51s. to 52s.; west coast, Clyde 52s. 6d to 54s. 6d., Manchester 50s. 6d. to 51s. 6d., Liverpool 51s. 6d. to 52s. 6d. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 2d.; North, 1s. to 1s. 1d.; 50-90 per cent., naked, London and North, 10½d. to 11½d.; Toluol, naked, London, 11½d. to 1s.; North, 11d. to 11½d. Crude naphtha, in bulk, London, 5½d. to 6d.; North, 5d. to 5½d. Solvent naphtha, naked, London, 1s. 1½d. to 1s. 2d. f.o.b.; North, 1s. 1d. to 1s. 2d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. 0½d. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3½d. to 3¾d.; North, 2⅞d. to 2¾d. ordinary, 3⅛d. to 3¼d, liquid. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east coast, 2s. 6½d. to 2s. 7½d.; west coast, 2s. 5½d. to 2s. 6½d. Naphthalene, £4 10s. to £9; salts, 45s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 2d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been a continuation of the improved inquiry in this article, which is doubtless assisted by the improvement in nitrate of soda.

COAL TRADE REPORTS.

Northern Coal Trade.

Though the demand for coal has been good, steamers have not been so plentiful. The market, therefore, has shown a little ease. In the steam coal trade, best Northumbrians are from 14s. 3d. to 15s. per ton f.o.b.; but there has been more competition with cheaper coal from other coalfields. Second-class steams are 12s. to 12s. 9d. per ton; and steam smalls are from 9s. 6d. to 10s. 6d. In the gas coal trade, the demand is now beginning to show a more steady increase. Best Durham gas coals are from 13s. to 13s. 6d. per ton f.o.b. Second-class are 12s. to 12s. 6d. per ton; and for "Wear specials," from 14s. is the current price. As to contracts, the sale is reported of some 12,000 tons for Porto Vecchio, at a price that is believed to be about 25s. per ton for Durham bests, delivered, in the next two months, in Italy. Other contracts are stated to be in treaty; but the high freights make some buyers hold off, though as the months pass on there is no sign of either lower freights or cheaper coal. Coke is steady. Rather more gas coke is being shipped for export; and good makes are from 19s. to 20s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Throughout Scotland the demand for all classes of coal is fully maintained. Any change in prices is in the upward direction. On Thursday, the f.o.b. prices quoted in Glasgow were: Steam coal, 11s. 6d. to 12s. per ton; splint, 12s. 6d. to 13s.; ell, 12s. to 12s. 6d.; trebles, 13s. to 13s. 6d.; doubles, 12s. 6d. to 13s.; singles, 11s. 6d. to 12s.

Felling a Chimney at the Hastings Gas-Works.—A page of the "Hastings and St. Leonards Pictorial Advertiser" for the 15th inst. contains a series of illustrations of the operations connected with the felling of a chimney 125 feet high at the old works of the Hastings and St. Leonards Gas Company. The chimney was originally built from the designs of Mr. C. F. Botley, Assoc.M.Inst.C.E., the Company's Assistant-Engineer, who superintended the arrangements for bringing it down now that it is no longer required—the manufacturing operations being carried on at the new works at Glyne Gap. On the old site is a disused retort-house; and Mr. Botley contrived that the chimney should fall upon and help to demolish it. The preparations were so well made that everything passed off without the slightest hitch. The chimney crashed through the roof and wall of the house; and the effect is seen in two of the photographs, showing the interior of the building with the breaches made in it and the resulting *débris*.

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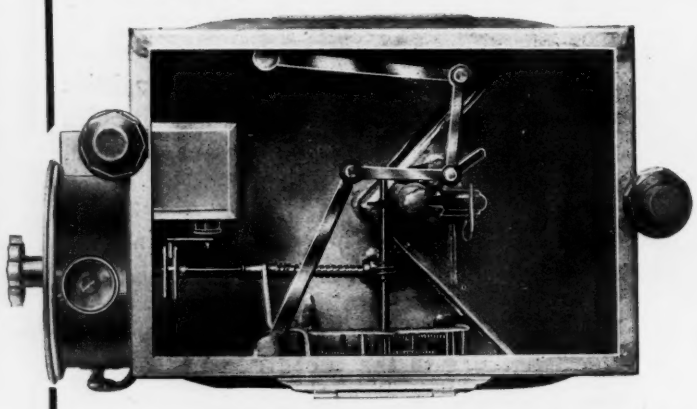

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Electric Junction-Box Explosion in the West-End.

An alarming explosion, which resulted in injuries to four persons, occurred last Thursday morning in an electric cable main at the corner of Duke Street and Jermyn Street, W. The injured were: Henry Leonard Martin (15), who sustained a scalp wound and fracture of his left leg and right ankle; Richard Rye (14), who had a bruised ankle; Thomas Dewyer (42), whose knee was injured; and Nelly Daly (16), who had a shock. It appears that workmen had been engaged in repairing an electric cable running down Duke Street. Smoke had been penetrating into the cellar of a neighbouring hotel, and then it was found to be issuing between the flagstones in the pavement. The Fire Brigade were summoned. By the time the firemen arrived, a considerable crowd had collected. The firemen at once began to get at the seat of the fire by breaking-up the pavement from underneath which the smoke was issuing. No sooner had they started on the work than there was a loud explosion at the junction-box about 30 yards away. The cover was blown off, and the boy Martin, who was standing upon it, went with it. He was removed, with the other sufferers, whose injuries were less severe, to Charing Cross Hospital, where he was detained; the others, after treatment, being allowed to go home. Several spectators had narrow escapes. For about 30 yards along the street, the pavement was displaced.

Flies in Public Lamp Bye-Passes.

In the course of the proceedings at the meeting of the Slough Urban District Council on Monday last week, reference was made to a complaint about the extinction of one of the public lamps. The Surveyor (Mr. W. W. Cooper) explained that it was one of the lamps where a clock had been installed before the present system was adopted, and not one of the newest kind. They had had the clock five years, and this was the first time it had substantially failed. The light was not out on any of the nights referred to, so far as he knew; but on three occasions it was only partially turned up—the bye-pass being choked by gnats or flies. They had many hundreds of these cases at this time of year. During the cold weather, the flies were attracted to the lamps for greater warmth. The members of the Council would be surprised if they saw some of the bye-passes, which were so choked with flies that the gas could not get through to receive full ignition. The Council would realize that with something like 400 of these clocks every one of them could not be kept perfectly correct, and some of the lamps might be a little late in being turned on. He could not accept the statement that the lights as a whole were not working satisfactorily. In many cases they were wilfully turned off; and he did not think the clocks should be condemned on this account. When the weather was normal, they would not be troubled with the flies; and, taking everything into consideration, he thought the clocks were working quite satisfactorily.

Gloucester Gas Company's Profit-Sharing Scheme.

The fourth annual meeting of the participators in the Gloucester Gas Company's profit-sharing and saving scheme was held at the works on Monday last week. Mr. J. H. Jones (the Chairman of the scheme) presided, and made the gratifying announcement that each member would this year receive a bonus of 7 per cent. on his wages. He explained that the object of the scheme is to create in each employee a personal interest in preventing waste, both of time and material; and as they make gas cheaper to the consumer, so, according to the rules, the greater is the bonus, to the extent of ½ per cent. for every 1d. reduction in the price of gas, given to the members. Since the initiation of the scheme, the Company have made two reductions in price—the first of 1d., and a subsequent one of 2d. It was announced that the Directors, at their meeting that day, had decided to make a further reduction of 1d.; making the price for next quarter 1s. 10d. per 1000 cubic feet, with a discount of 5 per cent. for prompt payment. This, it was stated, would admit of a bonus of 7½ per cent. to the employees next year. Half of the bonus is put into a trust fund, which cannot be touched by the men unless they leave the Company's service, or at their death; and the other half is put to a withdrawal account, which the members are encouraged to let stand to their credit. There is also a savings fund. On all three accounts (which at present total to £2116 11s. 5d.) the Company pay interest at the rate of 4 per cent.; and opportunity is offered to members possessing deposits of £10 to invest in the Company's stock. General satisfaction was expressed at the signal success of the scheme; the Chairman remarking that if it were adopted more generally by commercial concerns, he believed it would go a long way towards allaying labour unrest in the country. Mr. W. E. Vinson (the Secretary of the Company) said the amount standing to the credit of the members under the scheme averaged just over £13, exclusive of the savings fund.

Bawtry and District Gas Act.—In the list of Bills Royal Assented which appeared in the "JOURNAL" last week (p. 460), the name of the Bawtry and Tickhill Gas and Water Bill was inadvertently given instead of that of the Bawtry and District Gas Bill. The former was a competing measure, and the gas portion was withdrawn. The water clauses were fought in Committee; and eventually the preamble of the Bill was declared not proved.

Gainsborough Water Supply.—The present water supply at Gainsborough no more than serves the bare needs of the town, and for some months the Water Committee have considered various schemes for providing an increased supply. At the meeting of the Council on Monday last week, the Committee asked to be permitted to obtain the services of an expert consulting engineer, at a cost not exceeding £50, and take his advice upon the various schemes. Mr. Watson, the Chairman of the Committee, expressed the opinion that the Council were called upon to face a serious situation; and eventually it was unanimously decided to obtain expert advice.

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LEST YE FORGET.

Water Scheme for the Fylde District.

An inquiry was held last Wednesday by Dr. A. W. Brightmore, M.Inst.C.E., an Inspector of the Local Government Board, into an application by the Fylde Water Board for approval to the borrowing of £120,000 for the completion of the Grizedale Lea reservoir works, and £3000 and £1300 for the purchase of land and the erection of buildings. Mr. T. Loftos, the Clerk to the Water Board, explained that land for the reservoir was bought about 1902, but it was afterwards found that further storage would be required; and this was the object of the application. The Board had the Local Government Board's approval for borrowing the money; but, owing to difficulties encountered in the construction of the reservoir, they had already exceeded these powers by £19,585. Mr. John Cook, the Board's Engineer, said the reason the borrowing powers had been exceeded was owing to unforeseen circumstances which were pretty frequent in the construction of reservoirs; for there were defects which could not be discovered till the work had advanced. Mr. H. Rofe, the Consulting Engineer to the Board, supported the application; saying he was satisfied a perfectly safe reservoir could be constructed, and in all probability a tight one.

Utilization of Waste Coke-Oven Gas at Middlesbrough.—The Middlesbrough Corporation Gas Department have for some time been contemplating the adoption of a scheme for the utilization of waste coke-oven gas, and negotiations have been in progress between the Gas Committee and Bernard Samuelson and Sons. In connection with the project, the Corporation Gas Manager (Mr. David Terrace) and his Assistant (Mr. Blincoe), accompanied by Alderman M'Laughlan, are on a visit to Germany, to inspect the plant at Essen.

Kettering Gas Company.—The revenue of this Company in the six months ended the 30th of June was £16,318, and the expenditure £14,770; leaving a balance of £1548 to go to the net revenue account. The amount available for distribution was £3600; and at the recent half-yearly meeting the Directors recommended the payment of the usual dividends at the rate of 11¼ per cent. per annum upon the "A" stock, 8¼ per cent. per annum upon the "B" stock, and 5⅝ per cent. per annum upon the "C" stock. In proposing the adoption of the report and balance-sheet, the Chairman (Mr. J. T. Stockburn) said the Company were paying the same dividends as they had done for some years past, though the profits on the half year were something like £1050 less than those of the corresponding period of last year. This was due to the increased price of coal. The trade of the Company had been of a most satisfactory character; the increase in the output of gas having amounted to 7,603,000 cubic feet. The recommendation as to the dividends was adopted; and thanks were accorded to the Secretary and Manager (Mr. T. E. Maddocks) and his staff for the excellent way in which the work of the Company had been carried on. The Directors have decided to modernize the manufacturing plant by the erection of a new retort-house and coal-store.

Peterborough Gas Company.—The half-yearly meeting of this Company was held last Tuesday, when the Directors reported that there was a balance of £8113 to the credit of the profit and loss account; and they recommended the payment of dividends at the statutory rates of 5 and 7½ per cent. per annum on the preference and the consolidated stocks, less income-tax. These would absorb £3513, and leave a balance of £4600. Out of this the Directors proposed that £900 should be transferred to the insurance fund, and the balance of £3700 remain at the credit of the profit and loss account. The total revenue for the half year came to £18,619, of which £6501 was paid by ordinary consumers and £4732 by prepayment meter users; and for public lighting the Company received £1115—a total of £12,348 for 85,621,956 cubic feet of gas consumed. The dividends recommended were declared.

Dorking Water Company.—At the recent half-yearly meeting of this Company, there was a sum of £1377 available for distribution; being a net increase of £153 compared with the first half of last year. The Directors recommended the declaration of an interim dividend at the rate of 7½ per cent. per annum on the ordinary and 5½ per cent. per annum on the "B" shares. This, with the dividend payable on the preference shares, would absorb £1229, and leave £148 to be carried forward. The Directors proposed out of the balance to open a machinery depreciation account by placing £50 thereto. They said they had for some time past felt that, to ensure the maintenance of the supply of water to the town and neighbourhood, it was essential that the power of the engines and pumps should be increased. They had, therefore, decided to instal duplicate plant, at an estimated cost of about £1500. To provide this sum and to cover future extensions, the shareholders would be asked to sanction a further issue of shares. The dividends recommended were declared; and the Directors were authorized to raise additional capital to the amount of £2500.

Widnes Gas and Water Extensions.—The minutes presented by the Chairman of the Gas and Water Committee (Alderman Smith) at the meeting of the Town Council last Tuesday contained an application from the Sutton Manor Colliery Company and the Wigan Colliery Company for a supply of gas and water to property in course of erection at Sutton Manor and Bold. The houses already in existence number 113; and they are at present supplied by the St. Helens Corporation. It is estimated that during the next few years 1113 houses will be erected. To cope with this scheme, a water-tower will have to be constructed on Pex Hill on account of the high-lying nature of the Bold district. The tower will have a capacity of 500,000 gallons and cost £8500. The whole expense of the scheme will be £16,000, exclusive of such sums as may be necessary to purchase the gas and water plant used for distribution in a certain area. The Engineer (Mr. Isaac Carr, M.Inst.C.E.) estimated that the annual revenue from gas would be £1350, and from water £550, which would be sufficient to warrant the work being proceeded with. Several members deprecated the scheme until the whole of the houses were erected. Upon further details being promised, however, they passed the minutes.

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Leamington Corporation Water Undertaking.—The accounts of the borough of Leamington for the past financial year show that the income exceeded the expenditure by £2146, compared with £1902 before. As the result of last year's drought, 3 million gallons more water were consumed, and registered by meters.

New Reservoir for Lostwithiel.—The Mayoress of Lostwithiel (Mrs. F. A. Green) recently opened a new reservoir which the Town Council have had erected in St. George's Park for the purpose of regulating and distributing the water supply, which was given to the town by Viscount Clifden in 1895. Recently, owing to many new houses having been built on the higher levels, a shortage of water has occasionally been experienced; and it is to provide against this that the new reservoir has been constructed. It is of 80,000 gallons capacity, and has cost just over £800. Messrs. Jenkins, of Liskeard, were Engineers, and Mr. W. E. Bennett, of Bodmin, was the Contractor.

Cost of the St. Ives Water-Works.—An inquiry was held at St. Ives (Cornwall) by Mr. P. M. Crosthwaite, a Local Government Board Inspector, with reference to an application by the Town Council for power to borrow £1857 to complete the reservoir scheme. In 1909, the Corporation borrowed £18,150 for the construction of a reservoir, and the present application was stated to have been rendered necessary by additional work which was required. Mr. A. P. J. Cotterell, the Water-Works Engineer, explained that some of the work proved to be very difficult and expensive; the laying of the main necessitating excavation through solid rock. About £1300 was saved on the estimate for the reservoir.

Bolton Gas Workers' Wages Agreement.—The Bolton Corporation Gas Committee at last Friday's meeting had before them the resolution referred back by the Town Council relating to gas workers' wages and working conditions. As stated in the "JOURNAL" last week (p. 467), the matter was remitted to the Committee, so that there might be inserted in the agreement drawn up between the parties a clause fixing a period of years over which the agreement should hold good. Having fully considered the subject, the Committee fixed the period at three years. As already stated, the advance in wages to the men is one of ¼d. an hour all round; and it will mean an addition of about £600 per annum to the Gas Department's wages bill.

Chester Gas Company.—The report presented by the Directors at the eighty-eighth ordinary general meeting of this Company last Wednesday showed a sum of £7272 available for distribution; and they recommended the payment of an interim dividend on the ordinary stock of 2½ per cent. The Deputy-Chairman (Mr. R. L. Barker), who presided, in moving the adoption of the report and accounts, paid a tribute to the memory of the late Mr. James Garrett Frost, who had been upon the directorate since 1889, and had been Chairman since 1908. Continuing, Mr. Barker said twelve months ago the Company reduced the price of gas by 3d. per 1000 cubic feet, which had been equivalent to a concession to their customers of £1600; but there had been so large an increase in the consumption that the decrease in the receipts for gas was only £600. The report was adopted.

Artesian Tube Well at Amersham.—Messrs. C. Isler and Co., Limited, have completed an artesian bored tube well—the third they have fixed—for the Amersham Water Company, at Amersham, Bucks, under the supervision of Mr. A. F. Phillips, M.Inst.C.E., of Westminster. The borehole is 30 inches diameter, lined some distance with 30-inch internal diameter steel socketed tubes; the remainder being bored without lining into the chalk to a depth of 260 feet, full size throughout. On completion of the boring, a test was made, with the result that 40,000 gallons of water were raised per hour without appreciably affecting the head, even when pumping with the other existing boreholes.

On the recommendation of the Gas Engineer of the Southport Corporation (Mr. John Bond), duplicate plant for high-pressure gas is to be put down at the Eastbank Street works.

The Bolton Corporation Gas Committee have accepted the tender of Messrs. Robert Dempster and Sons, Limited, for the supply and fixing of a telpher machine at the Gas Street works.

Messrs. C. Isler and Co., Limited, have been entrusted with the work of supplying and fixing Diesel engines and the firm's air-lift pumping plants with surface pumps for the Limpsfield and Oxted Water Company, Limited.

Last Wednesday, George Chubb, the Secretary of the Wincobank Branch of the Gas Workers' Union, was committed for trial by the Sheffield Magistrates on a charge of misappropriating £47 6s. 3d., money belonging to the branch.

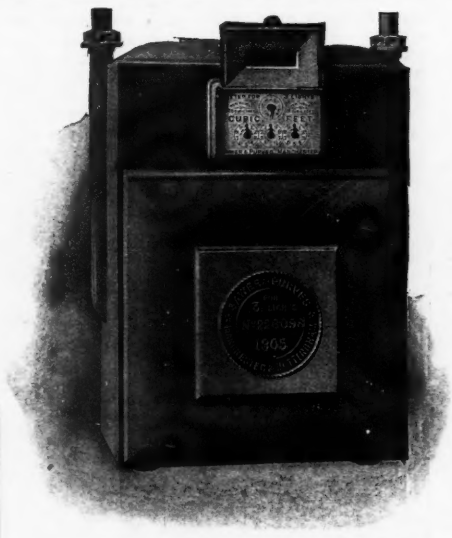
We have received from Messrs. Best and Lloyd, Limited, of Handsworth, their new list (No. 93) of the latest designs in "Surprise" pendants for inverted incandescent burners for this season's trade. The special features of these pendants are well known to "JOURNAL" readers.

Quite a panic was caused at the Morecambe Tower last Wednesday night by an alarm of fire. It afterwards transpired that an outbreak had occurred in the Manager's office, caused, it was said, by the electric light wire fusing and setting fire to a curtain and a number of papers.

The Patent Rapid Scaffold Tie Company, Limited, of Victoria Street, S.W., have sent us their latest booklet, containing reproductions of photographs of several important contracts, recently completed, on which their "Scaffixer" scaffold lashings were employed. These ties are used by the three London and by several Suburban and Provincial Gas Companies.

At the Bankfoot Collieries of Messrs. Pease and Partners, near Crook, County Durham, a few days ago, four men were overcome by gas fumes in a tar-still, and one of them, named George Foster, succumbed. He was engaged in repair work at the bottom of the still, and when affected he became jammed between some of the machinery, which rendered very difficult the task of the three men who went to his assistance. Two of the would-be rescuers have since died.

DRY GAS METERS.



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The Directors of the Waste Heat and Gas Electrical Generating Stations, Limited, have declared an interim dividend at the rate of 5 per cent. per annum on the issued share capital in respect of the half year ended the 31st ult.

The Southport Town Council, at last week's meeting, approved, without discussion, of the recommendation of the Gas Committee that a subscription at the rate of 2s. 6d. per million cubic feet of gas manufactured should be paid to the British Commercial Gas Association.

The New Mills and Disley District Councils have been officially advised that the Bill containing the Provisional Order of the former authority sanctioning an extension of the gas supply to the district of the latter has received the Royal Assent. To carry out the work, the New Mills Council have applied for powers to borrow £10,000.

Sanction to the borrowing of £25,000 for water-works purposes has been received by the Bolton Corporation from the Local Government Board. Of this amount, £15,000 is for prospective expenditure on water-mains during the next three years, and the balance for laying a main from the Sweetloves reservoir to the pressure filter installation at Ferns Bank.

Owing to the failure of the electric light through a defective cable, the town of Leigh was placed in semi-darkness last Tuesday night. The Theatre Royal, the Hippodrome, and the Public Library had to be closed; and at the baths a polo match was concluded by bringing gas into use. Fortunately it was the Tradesmen's Association half-holiday, and the great majority of the shops were closed. Those open for business had to revert to gas or candles.

At their meeting last Wednesday, the Oldham Corporation Gas Committee had under consideration a letter from the Factory Inspector of the Manchester district, who suggested that there was a risk of explosion in the coal-shed at the Hollinwood Gas-Works, owing to the atmosphere being at times heavily charged with coal dust, and the proximity of open gas-jets. He suggested that electric lighting should be adopted with the use of enclosed lamps. Alderman H. Wilde, the Chairman of the Committee, said he did not see how there could be an explosion in an open retort-house; and Mr. Arthur Andrew, the General Manager, observed that such an explosion had never been known to occur. The Committee decided to ignore the suggestion.

The Directors of the British Gaslight Company, Limited, at the half-yearly general meeting to be held next month, propose to recommend (subject to audit) a dividend at the rate of 10 per cent. per annum, with a bonus of 5s. per share, for the half year to June 30, both less income-tax, and payable in October. This is the same rate as last year.

Referring to the nests of titmice in one of the public lamps of the South Metropolitan Gas Company to which Mr. Doig Gibb, the Company's Chief Engineer, called attention in the July number of the "Co-Partnership Journal," as mentioned in the "JOURNAL" for the 16th ult. (p. 216), "Nature" says "the structure forcibly recalls a collector's cabinet of nests, and the occurrence is probably altogether unprecedented."

We learn that Messrs. Edward Cockey and Sons, Limited, of Frome, have recently secured the following contracts: A gasholder with steel tank and Tully's methane-hydrogen water-gas plant for the Hythe and Sandgate Gas Company; a spiral-guided gasholder for the Glenfell (Australia) Gas Company; retort-bench mountings for the Hurstpierpoint Gas Company; purifiers, washer, and retort-settings for the Woodbridge Gas Company; and a retort-bench and fittings for the Bradford-on-Avon Gas Company.

Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, have received an order from the Montreal Light, Heat, and Power Company to supply and erect, at their Outremont gas station, a steel tank 184 feet diameter and 32 ft. 6 in. deep, and a four-lift gasholder and guide-framing of a capacity of 3 million cubic feet. They are also adding two lifts, on their steel cable system, to a two-lift gasholder, 148 feet diameter and 32 feet deep, at the Portwood Gas-Works, Stockport, with the water in the tank, in a similar manner to that adopted with the previous holder altered by them at these works, which was fully described by Mr. S. Meunier, the Corporation Gas Engineer, in his paper read at the last meeting of the Institution of Gas Engineers. [See "JOURNAL" for June 18, p. 861.] The internal framing will be cut out of the crown, and supported on a timber framing lowered into the water, as mentioned by Mr. Meunier. The firm are also just completing the reinstatement of the two-lift gasholder which was damaged by the explosion in the meter-house at the Stratford-upon-Avon Gas-Works.

GAS COMPANIES' STOCK AND SHARE LIST.

The week just closed on the Stock Exchange has been a favourable one; and it would have been still more so if business had but been more active. Anyhow, it presented some agreeable features. Prominent among these was the recovery effected in Consols, and the concomitant advance in most of the gilt-edged division. The opening was a very quiet day; fresh business suffering from the commencement of the fortnightly settlement. But the tone was distinctly good, especially in the leading departments. There was really a good demand for Government issues, and Consols rose ¼. The secured issues of Rails were also wanted. Railway ordinaries were strong, with some nice rises; and Americans were up. The cheerful tendency was well maintained on Tuesday. Gilt-edged were still in favour, and Consols advanced ⅜. Rails improved their prices; and Americans were fair. On Wednesday, business was quiet. The tone was good, however, at the opening, and held so for most of the day; but there was some realizing before the close. However, Consols rose ¼; and Americans and Foreign were quite firm. Thursday brought about a change in temperament. All the chief markets were weaker, and sales predominated. Consols lost 5/16, Rails had shrinking prices, and the rest were much the same. But Friday introduced a welcome recovery in tone. All Government issues were in good request, Consols gained 5/16, and some Rails were better. Saturday was a quiet day, with a generally cheerful tone. Consols closed at 75⅝ to 75⅝ – a gain of ⅞ in the week. In the Money Market, rates were about steady and unchanged. Business in the Gas Market was a fair average, and the tone was good. In Gaslight and Coke issues, the ordinary was quite active at 107 to 108 *cum div.*, and 105 to 106 *ex div.*—a rise of ⅜. In the secured issues, the maximum marked from 82¼ to 83½, the preference from 99 to 101, and the debenture from 75 to 77. South Metropolitan was quiet at 118¼ and 119; and the debenture made from 77 to 78. One deal in Commercial debenture at 73½ was all. Among the Suburban and Provincial group, Alliance fetched 77, British from 44½ to 45, South Suburban from 121 to 123 *cum div.*, and 120 *ex div.*, and ditto preference 117½. In the Continental companies, Imperial changed hands at 176 to 179, Union at 84⅜, European at 19⅝, and Tuscan at 8½. Among the undertakings of the remoter world, Bombay realized 6¼, Monte Video from 11 to 11⅜, Oriental 135½ and 135¾, Melbourne 102, Primitiva 7 3/16 to 7¼, ditto preference 5 13/32 and 5 5/16, and River Plate debenture 94.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	73—78	..	6 8 2
374,000	Stk.	July 12	4	Do. 4 p.c. Deb.	89—91	..	4 7 11
250,000	5	Apl. 12	7½	Bombay, Ltd.	6—6½	..	5 15 5
50,000	10	Feb. 29	15	Bourne- } 10 p.c.	28½—29½	..	5 1 8
332,000	10	"	7	mouth Gas } B 7 p.c.	16—16½	..	4 4 10
75,000	10	"	6	and Water } Pref. 6 p.c.	14¼—14⅝	..	4 1 4
380,000	Stk.	Aug. 14	18½	Brentford Consolidated	255—260*	+1¾	5 3 10
330,000	"	"	10½	Do. New	193—198*	+½	5 6 1
50,000	"	"	5	Do. 5 p.c. Pref.	116—118*	+½	4 4 9
206,250	"	June 14	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
218,230	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	"	"	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12½	British	44½—45½	..	5 9 11
120,000	Stk.	June 28	4	Do. 4 p.c. Deb. Stk.	91—93	..	4 6 0
109,000	"	Aug. 14	6	Bromley, A 5 p.c.	127—130*	−1	4 12 4
165,700	"	"	4½	Do. B 3½ p.c.	98—100*	−½	4 10 0
82,278	"	"	5½	Do. C 5 p.c.	117—120*	+⅝	4 11 8
55,000	"	June 28	3½	Do. 3½ p.c. Deb.	78—80	..	4 7 6
250,000	Stk.	"	4	Buenos Ayres 4 p.c. Deb.	93—95	..	4 4 3
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	3½—4½	..	—
100,000	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	74—78	..	5 15 5
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	"	"	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	"	June 14	3	Do. 3 p.c. Deb. Stk.	73—75	..	4 0 0
800,000	Stk.	May 31	4	Continental Union, Ltd.	83—86	..	4 13 0
200,000	"	"	7	Do. 7 p.c. Pref.	133—135	..	5 3 8
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	"	—	4	Do. Deb. Stk.	103—105	..	3 16 2
840,150	10	July 26	10	European, Ltd.	19—20	..	5 0 0
16,160,600	Stk.	Aug. 14	4/17/4	Gas- } 4 p.c. Ord.	104—106*	+⅜	4 12 0
2,600,000	"	"	3½	light } 3½ p.c. max.	80—83*	−¼	4 4 4
4,062,235	"	"	4	and } 4 p.c. Con. Pref.	97—99*	..	4 0 10
4,531,705	"	June 14	3	Coke } 3 p.c. Con. Deb.	75—77	+1	3 17 11
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
82,500	"	"	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	16½—17	..	6 9 5
131,000	Stk.	Mar. 14	7½	Ilford A and C	157—160	+2	4 13 9
65,780	"	"	6	Do. B	123—125	..	4 16 0
65,500	"	June 28	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
4,940,000	Stk.	May 15	9	Imperial Continental	175—180	..	5 0 0
1,235,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	86—88*	−¼	3 19 7
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	216—218	..	4 11 9
718,100	"	"	7	Do. B.	156—158	..	4 8 7
806,083	"	June 28	4	Do. Deb. Stk.	99—101	..	3 19 3
75,000	5	June 14	6	Malta & Mediterranean	4⅛—4¼	..	6 3 1
560,000	100	Apl. 1	5	Met. of } 5 p.c. Deb.	—	..	—
250,000	100	"	4½	Melbourne } 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 31	3½	Monte Video, Ltd.	11—11⅛	..	6 1 9
1,775,892	Stk.	July 26	4½	Newc'tle&G'tesh'd Con.	98—99	..	4 8 5
529,705	Stk.	June 28	3½	Do. 3½ p.c. Deb.	85—85½	..	4 1 10
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	May 15	8	Oriental, Ltd.	134—136	..	5 17 8
60,000	5	Mar. 14	8	Ottoman, Ltd.	7⅜—8¼	..	4 17 0
31,800	53	Aug. 14	13	Portsea Island A	127—130*	+¼	5 0 0
60,000	50	"	13	Do. B	124—127*	..	4 14 6
100,000	50	"	12	Do. C	127—130	..	4 12 4
398,490	5	May 15	8	Primitiva Ord.	7⅛—7⅝	..	5 8 6
796,980	5	June 28	5	Do. 5 p.c. Pref.	5 3/16—5 7/16	..	4 11 11
488,900	100	June 1	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
312,650	Stk.	June 28	4	River Plate 4 p.c. Deb.	93—95	..	4 4 3
275,000	5	Apl. 12	12	San Paulo, Ltd.	13¾—14½	..	4 2 9
150,000	10	"	6	Do. 6 p.c. Pref.	11⅜—12½	..	4 18 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	234—236	..	4 4 9
209,984	"	"	10	Do. B	233—235	..	4 5 1
528,500	"	"	10	Do. C	233—235	..	4 5 1
90,000	10	May 31	7½	South African	8—9	..	8 6 8
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	117—119	..	4 11 9
1,895,445	"	July 12	3	Do. 3 p.c. Deb.	76—79	..	3 15 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	155—157*	..	5 8 3
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.	119—121*	..	4 16 3
60,000	"	"	5	Do. 5 p.c. Pref.	115—117*	..	4 5 6
117,058	"	July 12	5	Do. 5 p.c. Deb. Stk.	120—122	..	4 2 0
502,310	Stk.	May 15	5	Southampton Ord.	105—107	..	4 13 6
120,000	Stk.	Aug. 14	7½	Tottenham } A 5 p.c.	142—145*	+1⅜	5 0 0
483,940	"	"	5¾	and } B 3½ p.c.	114—116*	+⅜	4 19 2
149,470	"	June 28	4	Edmonton } 4 p.c. Deb.	94—96	..	4 3 4
182,380	10	June 15	5	Tuscan, Ltd.	8¼—8⅝	..	5 15 11
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97—99	..	5 1 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	110—112*	..	4 9 3
255,636	Stk.	"	6¾	Wands- } B 3½ p.c.	141—144	..	4 15 6
85,766	"	June 28	3	worth } 3 p.c. Deb. Stk.	70—72	..	4 3 4

Prices Marked * are "Ex Div."